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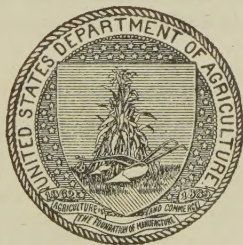
ANNUAL REPORTS
OF THE
DEPARTMENT OF
AGRICULTURE

FOR THE YEAR ENDED JUNE 30,

1913.

REPORT OF THE
SECRETARY OF AGRICULTURE.

REPORTS OF CHIEFS.



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[CHAPTER 23, Stat. L., 1895.]

[AN ACT Providing for the public printing and binding and the distribution of public documents.]

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Section 73, paragraph 2:

The Annual Report of the Secretary of Agriculture shall hereafter be submitted and printed in two parts, as follows: Part One, which shall contain purely business and executive matter which it is necessary for the Secretary to submit to the President and Congress; Part Two, which shall contain such reports from the different Bureaus and Divisions, and such papers prepared by their special agents, accompanied by suitable illustrations, as shall, in the opinion of the Secretary, be specially suited to interest and instruct the farmers of the country, and to include a general report of the operations of the Department for their information. There shall be printed of Part One, one thousand copies for the Senate, two thousand copies for the House, and three thousand copies for the Department of Agriculture; and of Part Two, one hundred and ten thousand copies for the use of the Senate, three hundred and sixty thousand copies for the use of the House of Representatives, and thirty thousand copies for the use of the Department of Agriculture, the illustrations for the same to be executed under the supervision of the Public Printer, in accordance with directions of the Joint Committee on Printing, said illustrations to be subject to the approval of the Secretary of Agriculture; and the title of each of the said parts shall be such as to show that such part is complete in itself.

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REPORT OF THE SECRETARY OF AGRICULTURE.

REPORT

OF THE

SECRETARY OF AGRICULTURE.

Mr. PRESIDENT: I respectfully present my report for the Department of Agriculture for the year 1913. I shall deal as briefly as possible with the business of the department, point out the changes in organization that have been made, summarize the more important results and developments, and indicate the recommendations submitted to Congress for action.

Those interested in the details of the work of the several bureaus and divisions will find in the reports from the several officers full and detailed information.

BUSINESS OPERATIONS.

The scope of the activities of the department is constantly increasing. When the department was first organized and for a number of years thereafter its work was confined largely to matters directly affecting agriculture. Later, the Weather Bureau and the Forest Service were transferred to the department, and more recent legislation has charged the department with the enforcement of numerous regulatory laws, including those relating to meat inspection, animal and plant quarantine, foods and drugs, game and migratory birds, seed adulteration, insecticides and fungicides, the manufacture of vaccines and viruses, etc., many of which have only an indirect bearing on agriculture. Its activities now affect not only those living in rural communities but urban dwellers as well, so it can be said that the work of the department at the present time concerns directly or indirectly all the people.

Appropriations.

To carry on the work of the Department of Agriculture during the fiscal year ended June 30, 1913, Congress appropriated \$16,651,496 for ordinary expenses, in addition to which permanent annual appropriations, special appropriations, and balances from prior years amounting to \$8,303,412.68 were available, making a total of \$24,954,908.68. The total funds which have been or will be returned to the Treasury as unexpended balances of appropriations and miscel-

laneous receipts aggregate \$3,132,303.82. Of this amount, there was received during the fiscal year ended June 30 last, from the sale of timber, for grazing, condemned property, etc., \$2,449,287.66, which has been deposited in the Treasury as miscellaneous receipts and can not be used unless reappropriated by Congress.

Comparison of Expenditures for Various Lines of Work.

The present appropriations for work of a regulatory nature or only indirectly affecting agriculture constitute about three-fifths of the total funds of the department, or approximately \$15,000,000, leaving two-fifths, or \$9,000,000, available for scientific research, experiments, and demonstration work directly affecting the farmer. While it would be difficult to segregate the funds which are used for purely demonstration work, because of its close relation in many instances to investigational work, it is safe to say that more than \$1,000,000 is devoted to such work.

Appropriations Recommended.

In the estimates for the next fiscal year I have recommended an increase in the appropriations for the department of \$1,074,387. The principal items in this increase are:

For extending the work of eradicating animal diseases, the enlargement of the work in feeding and breeding live stock, for dairying, and for enlarging and enforcing the meat-inspection law, \$250,860.

For the extension of investigations in connection with the introduction and breeding of new plants, the study and control of plant diseases, and the improvement of crop production with particular reference to cereals, \$45,660.

For the classification of agricultural lands and the survey of forest homesteads on the national forests, \$143,577.

For extending the investigations of the handling, shipping, and storing of poultry, eggs, and fish, which are carried on in connection with the enforcement of the food and drugs act, \$60,441.

For enlarging the investigation of fertilizer resources, soil-fertility investigations, and investigations of the chemical and physical properties of soils, \$24,420.

For extending investigations in connection with insects attacking deciduous fruits, cereals and forage crops, and forest trees, \$71,000.

For the enforcement of the migratory bird law, \$90,000.

For increasing the accuracy of crop forecasts and estimates, \$57,000.

For extending the study of road management and investigations of road construction and maintenance, \$113,550.

For investigations of the marketing and distribution of farm products, \$144,000.

For the inauguration of live-stock and crop demonstrations in the sugar-cane and cotton areas of Louisiana, \$50,000.

A recommendation has been made for the discontinuance of the present method of congressional seed distribution and the substitution of constructive work in the securing and distributing of new and valuable seeds and plants. This work can be done at a decreased cost of \$146,000.

By reorganizations in the work of the Weather Bureau a saving of \$37,340 can be effected, and yet the efficiency of the work can be increased. A decrease of the amount indicated has been recommended accordingly.

Improved Accounting System.

An important change in the system of handling the fiscal affairs and methods of accounting in the department was effected toward the close of the year. The change so far is proving very satisfactory, and is resulting in great economy in time and money.

A further change has been made. The administrative audit of accounts, formerly made in the Division of Accounts and Disbursements, has been transferred to the several bureaus. This change was made necessary by a provision in the act of August 23, 1912 (37 Stat., p. 375). The head of each bureau is now held responsible for the accuracy of accounts arising in his bureau.

Under the revised system of accounting the classification of expenditures according to their character, which was one of the features of the system inaugurated by the Commission on Economy and Efficiency, has been retained, but in a simplified form. The budget plan recommended by the commission is used to a considerable extent in preparing the annual estimates. The various supervising officers estimate the amounts which will be needed for the various items of expenditure, including salaries, travel, station and field expenses, equipment, apparatus, stationery, furniture, rent, freight, fuel, etc., and from these estimates the total funds which will be required for each line of work or activity are computed.

PERSONNEL.

The securing of men of the requisite training and experience in the various fields of agricultural science has been one of the serious problems which for some time has confronted the department. Two causes have tended to bring about this situation. One has been the low maximum salary which the department is permitted to pay to its scientific investigators as compared with the salaries paid by outside institutions and commercial concerns. The other has been the comparatively small number of strong, virile men who have been trained in scientific agriculture. Because of the great demand

for such men in this country and abroad, the department is constantly losing men whom it ought to keep, and it is unable to find an adequate supply of just the right type of man to replace them. With the growing demands for men trained in the newer fields of rural economics, rural sanitation, marketing, cooperation, and similar subjects, the situation is becoming acute.

Under the present law the maximum salary which can be paid is \$4,000. Many of the leaders in the department are men who could command salaries in many cases more than twice what they are receiving, but who remain because of their interest in the work. It is only fair to such men that the department should be in a position to recognize their services to the country in a substantial way.

The department has consistently maintained that its scientific work would be seriously handicapped by the creation of fixed or statutory positions for its scientific investigators, and that a system of fixed salaries would cause it to lose many men because of the great demand for their services on the outside. Authority is now vested in the Secretary to make promotions of employees engaged in scientific and technical work from time to time. Great care has been exercised to prevent abuse of this authority, and the plan has proved extremely satisfactory as well as economical. Practically all of the clerical and subclerical employees of the department are on the statutory roll, and no particular difficulty has been experienced under the system of fixed salaries.

Changes in Personnel.

There were 14,478 employees in the department on July 1, 1913. Of these, 2,924 were employed in Washington and 11,554 outside of Washington. Of the entire force, 1,812 were engaged in scientific investigations and research, 1,323 in demonstration and extension work, 687 in administrative and supervisory work, 6,021 in regulatory and related work, and 4,635 were clerks and employees below the grade of clerk. One thousand one hundred and thirty-four probational appointments in the classified service (positions subject to examination), 153 reinstatements, and 83 transfers from other departments were made during the past year. There were 2,699 promotions and 113 reductions in salaries. The resignations totaled 885; 227 appointments were terminated; 38 persons were removed from the service on account of misconduct; and there were 52 deaths. In the positions excepted from examination, chiefly agents and experts, there were 2,919 appointments made for temporary periods, 145 promotions in salary, and 115 reductions. Four hundred and twenty-four of these employees were separated from the service through removal, resignation, or death, and 1,925 appointments terminated.

Efficiency Ratings.

The need in the department of a uniform system of efficiency ratings and registers for clerical and subclerical employees on the statutory roll on which to base promotions has been felt for a long time. After conference with the civil-service officials, such a system was inaugurated early in the summer. It is believed that this system will eliminate to a large extent the danger of making favoritism or any other consideration rather than merit the reason for promotion.

The department is working in the closest possible relationship with the Civil Service Commission in the handling of its appointments. Because of the technical and scientific nature of much of the work of the department, it has been found difficult to secure the right kind of men from the regular registers of the commission. It has therefore been necessary to hold special examinations from time to time.

CHANGES IN ORGANIZATION OF THE DEPARTMENT.

The foregoing changes were made to promote economy, the orderly handling of financial matters, and the development of individual efficiency in the business force. Other changes in organization have been effected which aim to develop better coordination among the several bureaus of the department and between the department and other Federal departments and the State agricultural agencies.

REORGANIZATION OF THE WEATHER BUREAU.

Following the report of a special committee charged with suggestions for the reorganization of the Weather Bureau, changes have been brought about which reduce expense, eliminate certain duplications between Federal departments, and restore that bureau strictly to its field of scientific usefulness, from which at one time it had somewhat departed. Under this reorganization it will conduct its work wholly in the interests of agriculture, commerce, and navigation, and will plan its research work with a view to improving its services to these three important interests.

The Stations and Substations.

* One of the first steps will be the gradual reorganization of the stations and substations. This will include the elimination of stations and substations which are not needed, the limiting to forecasting of the work of stations which are not well located for carrying on climatological work previously assigned to them, the discontinuance of the issuance of complete maps from stations in territories where these maps have not proved of interest or particular value,

and the confining of the work of certain stations to special crop service. In this plan certain river, rainfall, and snowfall stations will be discontinued and changes will be made in the location of other stations to effect telegraphic, cable, and telephonic economies.

Cooperation with the Hydrographic Office.

Cooperation between the Hydrographic Office of the Navy Department and the Weather Bureau in the matter of the publication of marine meteorological charts has been effected. The Weather Bureau will discontinue the publication of marine meteorological charts and will hereafter supply to the Hydrographic Office for publication on the pilot charts all necessary meteorological data, and the Hydrographic Office will reciprocate by supplying these charts to all Weather Bureau stations requiring them.

Change of Plan at Mount Weather.

One of the most important recommendations is that the extensive work in meteorology, observation of terrestrial magnetism, study of solar and astrophysical problems, and aerial observations, hitherto carried on at Mount Weather, near Bluemont, Va., be discontinued, and that it be made a simple meteorological station for the taking of climatological records. The committee, in a complete report on the subject, found that the property at Mount Weather was purchased prior to 1903 and building operations begun early in the summer of that year. A committee of scientists from the bureau reported against the use of this property for aerial research in 1903, and within the past year other committees reported that solar radiation, upper-air research, and dynamic meteorology could better be carried on at other locations. For this reason the department has determined to discontinue the research work at this observatory and operate it simply for the taking of climatological records. This can be done by the man who will protect the property, at a total cost of about \$1,000 per year. This will make available approximately \$12,600, which can be expended to far greater advantage for scientific research.

Lines of Work.

The work of the Weather Bureau will be strengthened by increased attention to the matter of special crop warnings, designed to give growers of special crops an opportunity to take protective measures. This is particularly important for the southern fruit crops, which are subject to damage by unexpected frosts. The bureau will also develop its work of giving flood warnings to districts along waterways which are subject to sudden rises.

The forecasting and warnings service will be improved by the assignment of assistant forecasters to certain centers so that the evening forecasts for these districts can be made at the center.

The scientific work will include special attention to studies of storm, hurricane, frost, and cold waves, normal monthly storm tracts, the magnetics and thermodynamics of the atmosphere, solar radiation, quantity and quality of daylight, light intensity and sun and shade temperatures, temperature in relation to plant growth, evaporation, water requirements of crops, precipitation and snowfall, rivers and floods, and motions of the lower atmosphere—a study which is of growing importance, especially to aviators and engineers.

REORGANIZATION OF THE BUREAU OF STATISTICS (AGRICULTURAL FORECASTS).

It is proposed that the name of the Bureau of Statistics be changed to "Bureau of Agricultural Forecasts," as indicating more clearly the nature of its work. The figures compiled and published by the bureau are simply estimates or forecasts of crop prospects or production based upon the most careful use of all information attainable from thoroughly reliable sources. Much of the work of a purely statistical nature hitherto carried on by this bureau has now been assigned to other branches of the department or to other Federal departments to which it more properly belongs.

Cooperation with Post Office Department.

In the preparation of forecasts of production the department has entered into a cooperative arrangement with the Post Office Department which it is believed will make the figures of the estimates and forecasts still more reliable. Through this arrangement it is hoped that a system can be effectively inaugurated whereby the rural postmasters and rural route mail carriers will assist in collecting actual figures of total acreage and also gather complete figures of live stock.

Field Forecast Agents and Crop Specialists.

With a view to increasing the accuracy of its forecasts the bureau proposes to employ a number of specially qualified field forecast agents and crop specialists, to be obtained through rigid civil-service examination. The field forecast agents will be assigned to States in which agricultural production is not large and will spend their entire time in investigation of actual crop conditions within their territories. Crop specialists who have hitherto been used in gathering information on special crops, such as tobacco and cotton, will be employed to gather similar data on other important agricultural products. The system of collecting information through county, township, and individual voluntary correspondents will be retained, improved, and strengthened.

Simultaneous Publication of Forecasts.

It was found upon investigation that details of individual State forecasts must be in the hands of the farmer with the least possible delay if he is to gain from them any advantage in the marketing of

his own products. By simple and effective cooperation with the Weather Bureau this result has been achieved effectively and at a purely nominal cost. Under this plan the important details of forecasts for each State are telegraphed to the central weather station in that State. The weather station immediately prints copies of these figures, which show the forecast for that State compared with 10-year averages. The information is mailed without delay to all newspapers and agricultural and commercial publications within that State and reaches them within 24 hours, thus quickly reaching the actual producer. By this method the farmers in States distant from Washington get the State forecast, which, it has been found, is an even more important factor in the disposal of their products than the forecast of total production in the country, without the long delay which would follow if these State forecasts were mailed from Washington.

Committee of Cooperation.

In order to coordinate certain phases of the work of the Bureau of Agricultural Forecasts with other branches of the department, and also to prevent duplication of work and lack of harmony in statistical matters between the department and other Federal departments, a committee of cooperation has been established.

COOPERATION IN SOIL-SURVEY WORK.

With the view of making soil surveys more valuable to the farmer, a new basis of cooperation has been established with the States through their experiment stations, agricultural colleges, and agricultural bureaus. Under this plan the department will give precedence in conducting detailed soil surveys to those States which cooperate with the department in the matter and which request that such surveys be made. During the past year 19 States have appropriated money for soil surveys in cooperation with the department. If the request for soil surveys on the part of cooperating States absorbs all the department's funds for such work, no projects will be undertaken in noncooperating States. It is believed that where the soil surveys are made at the special request of the State agricultural agency and in districts where the State is actively engaged in extension work, the State authorities will be willing and able to help the farmer to gain the greatest possible benefit from the department's reports and soil-survey maps.

A second phase of cooperation in soil-survey matters has been the work of the department in limiting its so-called reconnoissance surveys largely to land classification of the national forests and to undeveloped areas of the country where detailed information is not immediately needed; work has been done in 10 States covering 30 projects.

COOPERATION IN LEGAL WORK.

Through cooperation with the Department of Justice arrangements have been effected during the year by the Solicitor for the more expeditious and economical handling of criminal cases and highly technical cases under the food and drugs act and the insecticide act. Hereafter the Solicitor will report criminal cases to the Department of Justice in the form of criminal informations, which, if approved by the United States attorneys, may be immediately filed. This will economize the time of the Department of Justice and expedite action in the courts. A similar system for handling all cases under the penal statutes committed to this department for administration will be recommended.

In the trial of the cases under these acts the points of issue frequently call for a complete understanding on the part of the legal representative of the Government of highly technical questions of chemistry and food or drug technology. The department therefore has made arrangements whereby in cases involving intricate technical questions the Solicitor and his assistants will assist the United States attorneys in the actual trials. In this way there will be placed at the disposal of the Department of Justice the more intimate knowledge which necessarily must be obtained by the Solicitor in preparation of the case than can be acquired by the United States attorneys through correspondence or in the restricted time at their command.

There is now under consideration a scheme of cooperation between the Department of the Interior and this department with respect to the handling of litigation involving claims to lands within the national forests, with a view to determining whether, and if so to what extent, there may be duplication of work. The ultimate purpose is to recommend such change in the procedure as may be necessary to eliminate such duplication.

CHANGES AFFECTING THE ENFORCEMENT OF THE FOOD AND DRUGS ACT.

Meats and Meat Food Products.

The decision of the Attorney General, and subsequent action by the Secretaries of the Treasury, Agriculture, and Commerce, in rescinding Regulation No. 39 placed meats and meat food products under the provisions of the food and drugs act, as well as under the meat-inspection law. Prior to that time meats and meat food products had been exempt from the operation of the so-called pure food law. Placing all these products under the provisions of this act called for the establishment of new machinery and certain reorganizations in the Bureau of Chemistry, and made necessary close cooperation between that bureau and the Bureau of Animal Industry. The general effect of the change was to give the Federal Gov-

ernment control over meat and meat food products in interstate commerce in all stages of their transit, instead of largely limiting their control to these products while they were actually within the jurisdiction of a federally inspected meat establishment.

Cooperation with the States.

It has long been recognized that inconsistencies between the food and drugs act and the food, drug, and dairy laws of the different States, as well as lack of uniformity in State legislation, have greatly hindered the prevention of fraud, adulteration, and misbranding in food and drugs and have made it difficult to induce manufacturers to improve their products. It is wasteful for the Federal food and drug authorities and the State authorities to work at cross purposes, and the department is making every endeavor to bring about effective cooperation. To this end, the Secretary invited all the State food and drug officials to attend a conference with representatives of the department to determine ways and means of bringing about better coordination of functions and closer cooperation. This conference was held on November 13 and 14 and attended by 23 food commissioners and 26 other State officials, representing 33 States, including Porto Rico and the District of Columbia. It was unanimously agreed by those attending the conference that effective cooperation was desirable, and agreements were reached as to specific measures which would aid in bringing this about. The conference made clear the necessity of establishing within the department an organization to be charged with the dissemination of information concerning the sanitary conditions of food production, violations of the law, new forms of sophistication, and new methods for their detection. The establishment of such an organization it is expected will do much to prevent duplication of research and investigation and make food and drug control far more effective. It is hoped also that with increased cooperation will come effective control through State agencies of conditions under which food factories manufacture their products, and better control of such foods as milk, eggs, oysters, and fish, which can be contaminated with micro-organisms and may communicate disease. Under the conditions of the Federal law the department can exercise no policing control over the actual factories and dairies, and detection of contamination resulting from unclean or undesirable conditions is most difficult in the finished product. Many of the measures recommended at the conference call for changes in existing Federal statutes, and the State officials have appointed a number of committees to prepare reports and practical suggestions as to measures that will tend to unify State and Federal work in this field.

Coordination in Inspection Work.

The effective administration of the food and drugs act has been hindered to some extent by the fact that the food and drugs laboratories and the food and drugs inspectors were acting independently of each other in the same territory. With two sets of absolutely independent officials in the same territory, each reporting directly to Washington, there could be little coordination. To avoid this, the United States will be divided into a few general inspection districts, each in charge of a competent official, and all laboratories and inspectors working in that territory will be under the same immediate direction. Certain of the smaller branch laboratories outside of Washington will be closed, because the same work can be done more economically and effectively in the larger laboratories, which have specializing chemists and more complete scientific equipment. The food and drug inspectors similarly will be grouped in the larger centers and will cover their territory by traveling from these centers.

Constructive Work.

This redivision also will make it possible for the different branch laboratories, instead of devoting their time almost wholly to the policing functions, to give attention to investigational work which has for its aim constructive improvement in the manufacture and handling of foods and the better use of agricultural products.

Special emphasis should be placed upon this constructive work and it should be the policy not merely to cause violators of the law to be punished, but to prevent the recurrence of violations by so perfecting processes of manufacture that only lawful products will reach the consumer. Saving of waste and economical utilization of products are becoming more and more important; the Government must conduct such investigations, since they are usually so costly that only the larger industrial corporations can undertake them independently. The results obtained by the Government are published for the use of all. The results of private investigation are either kept secret or patented and thus give an opportunity for monopoly. The constructive work in this way may be made to supplement the regulatory activity. Punishment under the law will become less and less frequent and necessary when the manufacturer has been taught how to send a safe product to market. The consumer will profit not only from the increased quality of the food but by the lessened cost of production.

Health and the Food and Drugs Act.

That the food and drugs act is purely economic in one phase and hygienic in the other is not always clearly understood. The wording of the act does not make this distinction clear. Thus, the word "adulteration" is used for the offense of substituting a less valuable though wholesome article in whole or in part for a more valu-

able one, and also for the addition of a deleterious substance to a food, or the sale of a food which is filthy and decomposed. Obviously the first is an offense against the consumer's pocket. The others may injure his health. In the past relatively more attention has been paid to the economic than the hygienic phase of the act. The most important hygienic task is the proper control of such foods as milk, eggs, oysters, and fish, which may communicate disease. In this connection, the cleanliness of food factories or sources of perishable foods which can become infected is most important. The department must combat unsatisfactory conditions in food sources mainly through education, and the policing function in the case of factories and dairies must be discharged largely by the States. It is believed, however, that the department can render assistance in encouraging the States to carry out this work for themselves.

Food and Drug Standards.

The establishment of legal standards for judging foods would render the food and drugs act more effective, less expensive in its administration, and supply needed legal criteria. Under present conditions it is necessary in the individual prosecution to establish by evidence a standard for each individual article. This procedure is very expensive, and sometimes its cost is out of proportion to its value. Moreover, it may result in lack of uniformity in different jurisdictions. With legal standards established, the control of foods would be more uniform and measurably less expensive. The lack of such standards is to-day one of the greatest difficulties in the administration of the food and drugs act. These standards, however, should be in the form of definitions, because numerical standards furnish recipes for sophistication. The standards, moreover, should be sufficiently flexible to permit improvements in production. Other serious limitations in the food and drugs act result from that act's definition of "drug." It is impossible to control cosmetics containing injurious drugs, and remedies for obesity and leanness or to prevent the use of wood alcohol in remedies for external application. The list of injurious drugs which must be declared upon the label is now limited, and authority should be given to require statements of other drugs and the new habit-forming or dangerous compounds which chemists are constantly producing.

FURTHER CHANGES IN ORGANIZATION NEEDED.

Still further changes in organization seem requisite. The Department of Agriculture, like other large institutions dealing with complex problems, has tended to develop into highly specialized groups, with somewhat arbitrary boundary lines, which have been defined more by the methods employed than by the object

sought. Such arbitrary divisional lines, separating branches of work aiming at a common result, produce a certain amount of jealousy and assumed conflict of interest and lost motion, leading eventually to stagnation. In the department it has become evident that existing divisional lines are beginning to militate against a desirable flexibility, and have in some cases allowed too little latitude in carrying out important projects. When in the past the department's work was on a purely divisional basis there was little need for coordination. This divisional basis was changed about 12 years ago into the present bureau system. The new plan for a time worked well, because the field was then a very broad one and was not covered fully by any single bureau or division. As the work has grown and different divisions have approached the same field definite handicaps have developed.

What is needed is a basic plan of cooperation, coordination, and broader grouping of the services of the department, according to the purposes in view, each with a larger number of small units, the development of a common feeling, and team work all along the line. Experience demonstrates that small units alone, each more or less interconnected with other units, will yield the greatest results, both in research and in its application.

To capitalize fully the results of research and to make the knowledge gained by the department of service to the people, the department manifestly must put itself in the best possible position to reach with its information the people who must change that information into productive action. To do this it must see that its policing or regulatory functions do not interfere with the gathering of its information, nor with the constructive rather than the preventive use of these data. It therefore must have a plan whereby not only friction is completely eliminated but whereby it is placed in a position to use to the fullest extent all outside agencies which can carry its information more directly to the people it seeks to serve. Probably this will best be accomplished by having in the department an organization involving five or six main groups, such as a research service, a rural organization service, a State relations service, a weather service, a forest service, a regulatory service, and others as new conditions or special occasion might warrant. With a view to the establishment of some such system the department in its estimates has submitted the following clause for the approval of the Congress:

The Secretary of Agriculture is hereby authorized and directed to prepare a plan for reorganizing, redirecting, and systematizing the work of the Department of Agriculture as the interests of economical and efficient administration may require; such plan shall be submitted to Congress in the Book of Esti-

mates for the fiscal year 1916; and the estimates of expenses of the Department of Agriculture for the fiscal year 1916 shall be prepared and submitted in accordance therewith.

NEW FIELDS OF WORK.

Heretofore the Department of Agriculture has, of necessity, concerned itself mainly with problems of production. It must give no less attention to these problems for a long time to come; they are still urgent. Increased tenancy, absentee ownership, soils still depleted and exploited, inadequate business methods, the relative failure to induce the great majority of farmers to apply existing agricultural knowledge, and the suggestions of dependence on foreign nations for food supplies warn us of our shortcomings and incite us to additional efforts to increase production.

The situation is one about which many have become pessimistic, but, of course, there is no ground for thinking that we have yet approximated the limit of our output from the soil. As a matter of fact, we have just begun to attack the problem; we have not even reached the end of the pioneering stage, and have only in a few localities developed conditions where reasonably full returns are secured. With a population of less than 95,000,000 living on more than 3,000,000 square miles it is unreasonable to speak as if our territory had been much more than pioneered. The population per square mile in the Union does not exceed 31, and ranges from seven-tenths of 1 in Nevada to 508 in Rhode Island. It is less than 76 per square mile in any State in the Union, except in eight eastern States and in Ohio and Illinois; less than 50 in any southern State; less than 43 in any State west of the Mississippi except Missouri; less than 25 in the great States like Texas, Washington, Nebraska, Oklahoma, Kansas, and California; less than 10 in the Dakotas, Oregon, and Colorado; and less than 5 in most of the Rocky Mountain Commonwealths.

Look at it from another point of view. According to the best statistics available it appears that the total arable land in the Union is approximately 935,000,000 acres; that only about 400,000,000 of this is included in farms and improved; that over 100,000,000 is unimproved and not included in farms; and the remainder is unimproved lands included in farms. But there is another thought. What about the efficiency of the work on the land now under cultivation? What part of it may be said to be reasonably, efficiently cultivated? What part of it is satisfactorily cultivated and is yielding reasonably full returns? The opportunity for guessing in this field is unlimited, but according to the best guesses I can secure, it appears that less than 40 per cent of the land is reasonably well cultivated and less than 12

per cent is yielding fairly full returns, or returns considerably above the average.

We have unmistakably reached the period where we must think and plan. We are suffering the penalty of too great ease of living and of making a living. It is not singular that we should find ourselves in our present plight. Recklessness and waste have been incident to our breathless conquest of a nation, and we have had our minds too exclusively directed to the establishment of industrial supremacy in the keen race for competition with foreign nations. We have been so bent on building up great industrial centers by every natural and artificial device that we have had little thought for the very foundations of our industrial existence.

Marketing.

In dealing with the problems of production, the department has directed its attention mainly to the problem of the individual farmer, and the broader economic problems of rural life have received relatively little attention. It is now becoming clear that we must definitely and aggressively approach these newer and, relatively speaking, urgent problems. We have been suddenly brought face to face with the fact that in many directions further production waits on better distribution and that the field of distribution presents problems which raise in very grave ways the simple issue of justice. That under existing conditions in many instances the farmer does not get what he should for his product; that the consumer is required to pay an unfair price; and that unnecessary burdens are imposed under the existing systems of distribution, there can be no question.

Just what part of the burden is due to lack of systematic planning, or inefficiency and economic waste, or to unfair manipulation, one can not say. As difficult as are the problems of production, they are relatively simple as compared with those of distribution, and there is danger not so much that nothing will be done, but that pressure will be brought to bear on the department to take action everywhere before it is prepared to act intelligently anywhere. The department has given assistance here and there in the past; it is prepared to give further assistance and information now, and it has shaped its projects and instituted more systematic investigations, which should have results of great practical value to individuals and to communities.

This extension of activity has been made under the act of Congress approved March 4, 1913, which confers the broad authority indicated:

To enable the Secretary of Agriculture to acquire and diffuse among the people of the United States useful information on subjects connected with the marketing and distribution of farm products.

Let us look at the matter briefly and consider some of the problems that must be attacked in this field. The department has arranged its marketing investigations under five important subdivisions:

First. Marketing surveys, methods and costs, including especially available market supplies in given production areas, demand at consuming centers, cold and other storages, marketing systems and prices, and costs of wholesale and retail distribution of farm products.

Second. Transportation and storage problems, having in mind the elimination of waste and the study of problems connected with surplus market supplies; terminal and transfer facilities, including freight congestion, car supply, deterioration in transit, extension of the practice of precooling of perishable products, and other special services.

Third. City marketing and distribution investigations, involving a study of the uses and limitations of farmers', municipal, wholesale, and retail market houses; systems of city distribution; the promotion of direct dealing between producers and consumers by parcel post, express, and freight.

Fourth. Study and promulgation of market grades and standards. A consideration of sizes and suitability of packages and containers, methods of preparation of perishable products, and the ultimate establishment, so far as practicable, of official market grades and standards for farm products.

Finally, cooperative production and marketing investigations. The department, as has been said, has already approached the field of marketing through various agencies. It has established standard cotton grades and has practically completed its standard corn grades. It has given much attention to cold-storage problems and to the packing and handling of perishable fruits. It is aware of the existing chaos and of the consequent wastes—waste resulting from faults on the part of the farmer in the growing and handling of his products; waste resulting from the machinery of distribution, including physical equipment and physical handling; waste resulting from the manipulation of those middle men who perform no clearly useful and necessary service; and waste resulting from ignorance on the part of the consumer and of the producer of the character of the product which is placed on the market. The producer of any product is entitled to receive an exact price for the specific product which he offers and the consumer is entitled to receive just the commodity he thinks he is paying for.

A failure in either direction involves clear injustice and greatly hampers production and crop improvement. Let me illustrate by reference to two vitally important crops—cotton and corn.

Several different standards of cotton classification are now in use. Some markets have adopted the official grades and use them. Others have adopted them, but do not trade on them. Liverpool has one set of grades, New York another. The former is a great market for both spots and futures; the latter almost purely a future market. Atlanta has its own grades; Augusta's are different. Savannah, handling largely the same character of cotton as the two foregoing, trades on Liverpool grades, using Liverpool middling as a basis. Atlanta middling is equal to Liverpool good middling. In other words, at the present time the same grade name is applied to two qualities that differ in market value as much as \$2.50 per bale.

The adoption and application of one uniform standard would result in a great simplification of all cotton transactions, doing away with the complex method of figuring buyer's limits. It would not be sufficient to have uniform grades, but the grade selected as the basis grade should be the same in all markets.

The local buyer knows the market cotton grades; the farmer does not. Too frequently the local buyer secures the cotton at practically a flat-rate basis on lower grades, grades the cotton himself, and sells it for what it is worth.

There is not only no incentive for placing a good product on the market, but as a matter of fact a penalty attaches to the cotton grower who takes the pains to improve his product.

Uniform standards throughout the cotton belt would result in the rapid building up of a body of common knowledge on the part of the farmers, students in agricultural colleges, and others interested in the universal set of grades. We might hope to educate cotton farmers in sufficient detail to enable them to use one set of grades, but it would be difficult, if not impossible, to teach them grading based on a number of diverse standards, as one can never tell to what market a given lot of cotton is to go. It would be necessary to have knowledge of practically all grades in use.

If in addition these grades were used on the exchanges and the terms of the contract employed were modified, many of the evils complained of by the producer and the consumer in the marketing of cotton would disappear.

Practically the same results would follow and the same evils would be removed if standard grades for corn were universally adopted. Definite standards for the grading of commercial corn and the uniform application of such standards in all markets under suitable Government supervision would be of direct value to our corn growers, in that such standardization would encourage the marketing of dry corn of better quality. Heretofore it has been the common practice

to pay practically the same price for all corn delivered at country stations, regardless of its water content or of its soundness. Farmers have not been slow to grasp the situation, and under such a system have naturally made but little effort to market corn in a dry and sound condition. The system has placed a premium on poor and careless farming at the expense of good farm methods and practices.

Under a definite system of grading and the elimination of such terms as "reasonably dry" and "reasonably clean," the farmer, as well as the grain dealer, will be able to know and fully understand the requirements for the different grades. With a knowledge of the grade requirements the farmer who markets dry corn of good quality will be in a position to demand a premium for such corn. It will not be necessary for him to accept a No. 4 price for corn which he sells under a grade designation of No. 3. He will then have some encouragement to exercise greater care in the harvesting, storing, and marketing of his corn; he can likewise ascertain in advance of sale with a fair degree of accuracy the grade of his corn while in the crib, and thus not market it until it is sufficiently dry to meet the requirements of a higher grade. The way will be open for real progress in the movement for the production of more corn of better quality, and farmers who grow corn primarily for market will have an incentive to grow earlier maturing varieties, which will contain less moisture when marketed and can be sold at a premium. Likewise, the country shipper will be in a position to pay a premium for good corn, in that he, in turn, will have the assurance of the same definite system of grading regardless of the market to which he ships.

Cooperation.

Several things stand out very clearly at this stage of our knowledge. All this waste must be eliminated. In simple justice the producer must be paid specifically for what he produces and for nothing else, and the consumer must receive what he thinks he purchases and must be willing to pay a fair price for a good product. It is clear that before the problems of marketing, the individual farmer, acting alone, is helpless. Nothing less than concerted action will suffice. Cooperation is essential. The same business sense and the same organizing genius which have placed this Nation in the front rank in industry must be invoked for agriculture. Reflection suggests this; experience demonstrates it. All the successful attempts in the marketing of any produce anywhere in the world have come through organized effort. The individual farmer has neither adequate information nor the facilities.

There are dangers here, of course. Cooperation can not result in an organization which shall attempt to establish a closed market and

to fix prices. We shall doubtless condemn this as strictly in one field of industry as in any other and it would be as unnecessary as it would be unfortunate. The aim should be an economic arrangement which shall facilitate production, lead the producer to standardize and to prepare his product for the market, and to find the readiest and best market for his product. Such action will result in gain to the producer as well as to the consumer. Furthermore, it is desirable that such concerted action shall proceed from below upward. It must concern itself with the overcoming of a specific economic difficulty in this field of production and distribution. It should associate itself with some particular product which is capable of being standardized. Experience shows that the best results are secured only when the members of such a cooperative society are those who are bona fide producers.

Many enterprises in the United States claiming to be of a cooperative nature have existed and do exist. They are of all sorts and descriptions; some are truly cooperative, others are clearly exploited. Some operate on principles that are sound; others on principles that are obviously bad. A form helpful to one undertaking is not necessarily the best for another, and one successful in one community under certain conditions can not necessarily be expected to succeed under other conditions in another community.

Here, again, the need is for information, and the department, acting in cooperation with the General Education Board, has devised machinery and instituted investigations into this field of cooperative effort at home and abroad. There are many facts to be ascertained. We desire to know and to estimate the various sorts of enterprises afoot in order to be able to give the people information concerning the principles and practices of the best forms of cooperation.

At the earliest practicable moment the department will disseminate the information, and if circumstances warrant and funds are available will assist in making such demonstrations as may be practicable.

Rural Credits.

There is a general impression that our financial arrangements do not satisfactorily cover the rural communities and that there is need of better credit arrangements for farmers. The interest is widespread. It is manifested in many letters received at the department, by articles in periodicals, by the action of various States, and by the thought of Congress in providing for a commission of inquiry abroad. It is significant that the commission provided for by Congress was accompanied by delegates from practically every section of the Union. The results of the inquiries of this commission are not yet published, but they will doubtless be available in the very

near future. For a long time economists have known of the foreign arrangements, but their writings have reached comparatively few people. The report of the commission and the public interest in its trip abroad will give wide publicity to its findings. It was apparent to the department that a knowledge of foreign arrangements should be supplemented by a study of home conditions, and through cooperation with the General Education Board a survey of home conditions was undertaken, and much valuable information has been secured.

It is clear that conditions vary widely in the United States, that farmers do not equally need better credit arrangements, and that all sections are not similarly circumstanced. In fact, from some sections comes requests not so much for capital at lower rates as for information as to how to invest capital.

There is considerable variation of the interest paid by farmers on long and short time loans, both as among States and as among different sections in the same area. In the older States of the corn belt, such as Iowa and Illinois, the usual rate on farm-mortgage loans appears to average a little over $5\frac{1}{2}$ per cent, whereas in such States as Montana, Colorado, and Oklahoma in the West, and Florida in the South, the annual charge on similar loans appears to be $8\frac{1}{2}$ per cent or more. Similar variation is apparent in rates to farmers on short-time loans on personal or collateral security. These vary from an average of less than 7 per cent in States like Illinois to an average rate of 11 per cent or more in Oklahoma, Colorado, and Montana. Furthermore, the interest on long-time loans in northern Minnesota exceeds by 3 per cent the usual charge in southern Minnesota. In States like Illinois, where the conditions are more uniform, the variation is slight, ranging from $5\frac{1}{2}$ to 6 per cent between northern and southern Illinois. In the case of short-time loans there are greater variations, ranging from $8\frac{1}{2}$ to $14\frac{1}{2}$ per cent or more in Colorado and Oklahoma and from $6\frac{1}{2}$ to about 8 per cent in Illinois.

It is not easy to explain just how these variations arise or to decide whether we may more nearly equalize the opportunities for credit in the various sections, and if so, how. There is no one single complete explanation. Many factors enter: Climatic conditions, soil conditions, stability of industry, methods of farming, distances from markets, distances from centers of large wealth, and the nature of financial agencies through which capital is secured all play a part in determining the availability of capital and the rate of interest.

But when all necessary allowance has been made for these fundamental factors, the fact remains that the rural communities are not as efficiently served as they should be by existing financial arrangements. It is not improbable that they can not be as completely

served as urban communities are, but improvements can be made. Certain provisions of the pending currency bill have been inserted with the definite view of remedying the defects. What further action should be taken presents a difficult and complex problem. Whether the legislation should be exclusively State or exclusively Federal, or partly State and partly Federal, and whether different agencies should be devised to meet the demand for short-time and for long-time loans are some of the points to be decided.

Long-time loans are needed for permanent investments, such as the purchase price of a farm or for the erection of buildings. In this country the usual method employed in securing capital for such purposes is through farm mortgages. Abroad, in France and Germany, separate financial machinery by means of which capital is rendered available at low rates for permanent purposes has been devised. Bankers in this country realize the wisdom of giving definite encouragement to farmers who borrow money for productive improvements, and the farmer realizes the importance of securing capital for such purposes. Here is presented one of the important problems in connection with rural credits, in some respects the most important. It is wise economy to encourage the extension of credit for safe productive use, and no less wise to discourage the use of capital along nonproductive or speculative lines. There is no doubt that much capital has been wasted through misdirection and much consequent difficulty presented in the projection of a new scheme. The need of encouraging the placing of capital in the hands of the farmers at reasonable rates for productive purposes is made evident by the rapid increase of tenancy in various sections. We no longer have abundant free homesteads that afford farms and homes for immigrants as in the earlier days. The rapid increase in farm values and the difficulties in securing land have given impetus to the growth of the renting system. It is this tendency especially that suggests the importance of devising farm loans on terms such as will enable the producers to make the necessary payments on the interest and principal, so far as possible, from the returns of the land itself. The plan of issuing farm debentures has been advocated where the bond issues are blanketed on farm mortgages, and where the latter are issued for long periods of time, running from 10 to 60 years, with the amortization feature attached. Such a plan has operated with success abroad. Some organizations in this country have met with apparent success in this direction. A land-mortgage bank organized as a private-stock company and embodying features of the French Credit Foncier has been operated for some time in Illinois. This company lends money on farm mortgages and issues debentures which are sold to the investing public. The plan most in use by it is

to have each thousand-dollar mortgage carry a uniform semiannual payment of \$43.26, which covers 6 per cent for interest and enough on the principal to extinguish the loan in 20 years. Each loan is limited to 50 per cent of the value of the farm, and all mortgages are restricted to lands within the State. It would appear that this plan can probably be used safely only where farming has reached a stage of relative permanency and where the conditions are fairly uniform. Under other conditions the investing world may not be willing to look with favor upon blanket debentures unless the financial standing of the institution issuing the securities inspires great confidence. In such regions investors appear to prefer a direct lien on the specific farms regarding which they possess definite information, and here the problem becomes one of directing effort toward the widening of the market for such mortgages by providing for their resale and repurchase through well-organized and responsible agencies.

In addition to this improvement in facilities for long-time loans through the widening of the market for farm securities, there is another line of effort which may yield favorable results in improving credit conditions. This will involve the drawing more effectively on existing local capital through better opportunities of investment. An interesting example is the familiar building and loan association. The activities of such associations in urban communities are well known. Attempts have been made so to modify such organizations as to adapt them to the needs of the farmers. This is true especially in Ohio, where there are 650 building and loan associations, of which more than 500 furnish loans to farmers aggregating more than \$12,000,000. These are found in 82 out of 88 counties in the State. In each of the 82 counties these associations extend loans to farmers at a usual rate of 6 per cent. The loan contracts are reported by the State department as varying from 1 to 16 years, but in nearly all instances the farmers prefer 2 to 5 year contracts with interest payable quarterly or semiannually. This experience may suggest that there is opportunity for the formation of farmers' associations that will stimulate thrift, mobilize local capital, and tend to the increase of owned farms.

What has been stated is, of course, tentative, and is not intended by any means to exhaust the subject. Enough has been said to emphasize the thought that the improvement of rural credit facilities may be solved through several approaches and not by any single agency, and that the full solution of the problem involves the general improvement of agricultural conditions, greater permanency, and greater uniformity.

The second problem is how to improve conditions under which farmers may get short-time loans. Here again we encounter special

conditions and special needs. All sections again are not equally circumstanced. The small farmer with little credit, or the farmer who is just getting himself established, is the one to whom attention would naturally be directed. The operations of many of them, taken singly, are too small to engage the attention of those who have capital to lend, and in many cases the situation is so precarious as to prevent favorable consideration of requests for loans.

It is, of course, requisite that a credit foundation exist; that there should be the usual combination of character and security, but even where these conditions are satisfied the situation is still unsatisfactory. The suggestion of the formation of farmers' credit unions merits serious consideration. The aim of such organizations is not to supply a new banking system but rather to establish a credit foundation or to utilize a collective good will which does not exist so long as the farmer acts individually. In this field Europe has developed beyond us. To what extent their institutions can be followed here needs serious study. It is probable that the unlimited liability feature of some of their schemes will not appeal to American farmers in most sections of the Union. Nevertheless, in those parts of the country where the system of merchants' advances to farmers has brought a great many borrowers into the relation where their individual liabilities to the lenders is already unlimited, it would not seem to be revolutionary to encourage the establishment of local cooperative credit societies and to transfer the features of unlimited liability of the borrower to a group of producers.

The main thing is to develop, either through individual or group action, a credit foundation and a form of security which will attract existing capital, partly perhaps through existing agencies.

In taking action in this field of rural credits it would seem desirable that we bear certain guiding principles in mind. There does not seem to be any real demand or need for action which would do more than provide as adequate financial machinery for the rural districts within practicable limits as is provided for other sections. There does not appear to be need for unique legislation or for legislation which shall aim to give the farmer credit on easier terms than other members of society secure. What is needed is the creation of conditions and machinery which shall enable him on similar credit foundations to secure money at the same rates as those that prevail for other classes. Present conditions do not seem to justify proposals to give any class of people capital provided by all the people through any device at lower rates of interest than economic conditions normally require or than those at which other classes secure it under similar conditions. Certainly the American farmers themselves will examine every method of improvement suggested within

the fields of self-help before seeking special provision for agricultural industry through national loans or other devices.

Other Rural Organization Problems.

Even though the problem of how the farmer can best sell his produce and can improve the conditions under which he can secure the necessary capital were solved, there would still remain vital things to be accomplished before rural life can be made fully efficient, profitable, healthful, pleasurable, and attractive, and before a larger disposition to remain on the farm develops. Good roads are prerequisite for better marketing, for better schools, and for more comfortable rural living. Better sanitation and hygiene in the home, in the school, and in the community are just as vital for the rural community as for the urban. Many agencies are attacking these problems. It is highly important that the local political machinery shall be more fully vitalized and become more efficient in its care of community welfare.

Much of the work of the improvement of rural conditions lies outside the field of immediate effort of the Department of Agriculture, but it is attacking directly more of these problems than is commonly recognized and will leave nothing undone to contribute directly to their solution. It is clear that much time and great patience are essential and that some of the results desired will come early in the future, many of them as by-products of the work of the various agencies.

The department is giving special attention to the subject of farm management with the view of rendering to the farmer service similar to that rendered to the business man and the manufacturer by efficiency experts and engineers.

It is proposed especially to emphasize the enforcement of the food and drugs act, so far as the law permits, for the better protection of all the people, rural as well as urban. Much of this work must of necessity take the form of constructive education; that is, of placing in the hands of the people and of their officials information necessary for protection, and of giving them cooperative assistance.

This work could be very much extended if the States, in addition to efficient, well-organized State health boards, had machinery extending into each community in charge of full-time experts.

An intimation of the work the department is doing to protect health may be conveyed by reference to its study of insects which carry disease throughout the country.

Relation of Insects to Health.

In the case of a number of these insect pests, they intimately affect agriculture. A striking example is malaria, which prevents the

proper agricultural development of enormous areas of fertile land in the United States and greatly reduces the efficiency of plantation labor. The work regarding malarial mosquitoes carried on during the year consists in determining the insect losses which occur and the formulation of plans of control suitable for plantation conditions.

The house fly, known to carry typhoid fever and other diseases of men, has been studied for some time. Recently this study has centered on the discovery of effective and economical methods of destroying flies in their breeding places. The chief breeding place of the fly is the manure heap, and it has been realized that a method must be discovered which will kill the fly and yet not lessen the value of the fertilizer. Satisfactory progress has been made, and an announcement concerning new methods probably will be issued before the end of the year. An investigation of the stable fly, which is an important enemy of live stock and also is suspected of carrying infantile paralysis and other diseases, has been in progress. Studies have been made of the Rocky Mountain spotted-fever tick, with a view to the eradication of this pest in a locality in Montana where an especially virulent phase of the disease existed. Still another investigation had to do with the possibility that pellagra is transmitted by insects. This has not yet been demonstrated. If insect transmission is proven, however, another important malady will be added to the list of those which may best be dealt with by controlling the insect carrier.

THE WOMAN ON THE FARM.

The woman on the farm is a most important economic factor in agriculture. Her domestic work undoubtedly has a direct bearing on the efficiency of the field workers, her handling of the home and its surroundings contributes to the cash intake, and, in addition, hers is largely the responsibility for contributing the social and other features which make farm life satisfactory and pleasurable. On her rests largely the moral and mental development of the children, and on her attitude depends in great part the important question of whether the succeeding generation will continue to farm or will seek the allurements of life in the cities.

According to the testimony of many who are thoroughly familiar with conditions, the needs of the farm woman have been largely overlooked by existing agricultural agencies. Endeavor has been largely focused on inducing the field workers to install effective agricultural machinery and to employ the best methods of crop production. The facts that the woman's work and time have a real monetary value and that her strength is not unlimited have not been given the consideration they deserve. As a result, on many farms where there is always money enough to buy the latest agricultural appliance there is seldom

a surplus to provide the woman in her productive work with power machinery that will lighten her physical labor, running water that will relieve her of the burden of carrying from the pump all water used in the household, or kitchen equipment and household devices that will save her time, increase her efficiency, and enable her to make important monetary saving.

Home Management.

The department believes that intelligent help to women in matters of home management will contribute directly to the agricultural success of the farm. It purposes, therefore, to ask Congress for means and authority to make more complete studies of domestic conditions on the farm, to experiment with labor-saving devices and methods, and to study completely the question of practical sanitation and hygienic protection for the farm family.

The farmer's wife rarely has access to the cities where labor-saving devices are on competitive exhibit, nor does she often meet with other women who are trying these devices and gain from them first-hand information. It seems important, therefore, that the department, cooperating with the proper State institutions, should be ready to give the farm home practical advice. Some work has already been accomplished in studying the problems of nutrition and advising the women in the country as to the economical use of various foods and methods of using these foods to obtain variety in diet. Apparently there is need also for advice on general diets that will be healthful and varied, because the farm home usually has but a limited number of foods at its disposal and has not the opportunity to add novelties to the diet, such as the city woman finds in her convenient store.

Fields in Which Help Is Desired.

To ascertain the fields in which farm women desire specific assistance, a letter of inquiry was addressed to the housewives of 55,000 progressive farmers in all the counties of the United States. This letter asked no questions and left every woman free to discuss any need which occurred to her. She was invited to take the matter up with her neighbors and make a reply which represented not merely her personal need but the recognized need of the women of her community. Replies to this letter have been received in great numbers. Time has been lacking for a complete analysis of these letters, but from those which have been read so far it is evident that women want help in practically every phase of home management, from the rearing and care of children to methods of getting the heavy work, such as washing, done by cooperative agencies. Many women seek means of increasing the precious personal income which they receive from poultry, butter making, or the garden in their care. Many asked the department to suggest new handicrafts or gainful home occupations,

and others seek better means of marketing the preserves, cakes, or fancywork that they now produce.

The overwork of farm women and their fear of the effect of overwork on their children is the text of many of these letters. The difficulty of securing domestic help, due seemingly to the fact that daughters of farmers no longer take positions as home makers, has added to the farm housekeeper's burden. Many ask the department to prove to the men that their work is worth something in dollars and cents. Still others express a realization that their own lot is hopeless and self-sacrificingly ask that better things in the way of education, cheaper schoolbooks, improved schools, lectures, libraries, and amusements be provided for their children. Many request that the department establish a woman's bureau, issue weekly or other publications designed for women and dealing with matters of cooking, clothing, home furnishing, education of children, care of the sick, etc.

POPULARIZING THE DEPARTMENT'S WORK.

The realization that information of great value to the people is being gathered by the department's specialists more rapidly than it could be circulated led to a revision of the system of publication and to the establishment of a special information service.

New Classification of Publications.

It is fully realized by the department that the printed page or written statement, or even the institute address, can never be as effective in getting the farmer to understand and adopt practical methods as the man-to-man cooperative work of the demonstration service. Unfortunately, however, it is impossible at present to reach every farmer even once a year by word of mouth, and it will always be impossible to send direct messages to him to communicate new discoveries without delay. In planning the new system of publications and the information service the aim has been to reach with the least delay the largest possible number with the printed message and to place it in their hands in a form which will approximate as nearly as possible the work of the demonstration agent.

Accordingly, on July 1, 1913, a new plan of publication work was adopted, constituting a decided change in the character and classification of the department's publications, the object being to draw a sharp line between the strictly scientific and popular publications, so as to prevent the waste arising from the miscellaneous distribution of the scientific bulletins and to make a wiser distribution of the popular publications. The confusion which has always existed as the result of a multiplicity of series of publications has been eliminated, so that instead of having no less than 40 different series there are at present but 4, namely, (1) departmental bulletins, in which the

popular and semitechnical results of investigations are published, and of which 50 have already been issued; (2) the serial publications (including the Journal of Agricultural Research, for the strictly scientific papers, and the Experiment Station Record); (3) the Farmers' Bulletins, which are to be reduced in size and designed to give specific directions for doing things, with the object of making them more popular and useful; and (4) annual reports and other congressional publications, including the Yearbook and Soil Surveys, all of which are to be reduced in size and made more readable.

The demand for information which the people have a right to obtain from the department was never as great as it is to-day, and the new classification affords an economical and satisfactory way of meeting the requirements of all who are interested in our work.

Information for the People.

The edition of any single bulletin or publication necessarily is limited, and in consequence can reach but a small percentage of the population that could make use of it. In addition, it was found that there was much valuable material which, to be useful, ought to be gotten into the hands of the people within a few days or hours, and which if subjected to the necessary delay of formal printing would be of little service. The Office of Information was therefore established for the purpose of preparing brief popular statements of facts, which are to be supplied to the country. This office gathers these facts from the printed material and from the typewritten report and by direct interview with the specialists. This material is then prepared in simple news form, mimeographed, and given to the papers, particularly in the special districts to which it applies. It is also issued in the form of a weekly letter which is sent to more than 50,000 crop correspondents and progressive farmers. The notice may take the form of warnings against fraud in seeds and foods, notices of quarantine against plants or animals, advice as to means of combating crop or animal pests, or general information as to the handling of various crops. The various publications to which they are sent apparently are finding that these notices are of interest and value to their readers. The material sent out by this office is limited entirely to making known the facts of discovery and the official rulings of the department.

RELATIONS WITH THE STATE AGRICULTURAL INSTITUTIONS.

Reference has been made to proposed changes in legislation making for closer relations with agricultural institutions within the States, especially the agricultural colleges and experiment stations. It is self-evident that no very sharp line of distinction can be drawn between the functions of the Federal Government and those of the agricultural colleges and stations.

Certain guiding principles, however, may be proposed, and if these are observed there need be no fear of conflict. As might be expected in a country growing as rapidly as ours, where conditions affecting agriculture are so changeable, relations between the institutions within the States and between the State institutions and the Federal department have not always been as satisfactory as might be desired. As the work progresses it becomes more and more evident that the Department of Agriculture has well-defined functions, such as those controlling regulatory matters where interstate commerce is concerned, broad questions of administration affecting the conservation of soils, waters, and forests, studies of meteorology in its relation to commerce, and other problems of this nature. The Federal Government is also concerned with research problems, especially those affecting regulatory matters and the broader administrative questions already discussed. Its research work, therefore, should lie in regional rather than in local fields. The Federal Government accumulates a large amount of information which it should place in the hands of the people, especially the people on the farms and in the farm homes. The States are concerned with educational matters, with research, and with the extension of the results of research.

COORDINATION OF ACTIVITIES.

As the Federal Government makes appropriations for this type of work within the States and is also making appropriations to the Federal department direct, it is proper that all the agencies coordinate their activities in such fashion as will bring the best results and preserve the integrity of the institutions involved. Unquestionably these relations can be brought about without compulsion of law. They may be accomplished voluntarily by the men in the various institutions directing the work.

In order that a proper understanding of relations might be secured, several conferences have been held with the executive committee of the Association of Agricultural Colleges and Experiment Stations. As a result of these conferences there developed certain views which have been formulated in the following memorandum. This memorandum was signed by all the members of the executive committee and was approved by me.

The executive committee of the Association of American Agricultural Colleges and Experiment Stations desires to express to the honorable Secretary of Agriculture its great gratification at the attitude of his department in its effort to bring about a closer and more efficient relationship between the work of the department and that of the colleges and experiment stations.

(1) The executive committee heartily indorses the suggestion of the Secretary that as a means of inaugurating and perpetuating an intelligent and sympathetic cooperation of these agencies, there be established a permanent com-

mittee on the general relations of the department and the colleges, said committee to be made up of representatives from both the department and the association.

RESEARCH.

(1) The executive committee cordially agrees with the point of view of the Secretary that the primary function of the Federal department is to undertake the study of problems that are more particularly regional, interstate, and international in character, and that upon the stations should rest the responsibility of investigating the problems that arise within their respective States.

This general policy is not to debar a union of effort by the department and a given station in the study of a problem whenever it becomes evident that such cooperation is necessary or will tend to a more successful outcome.

(2) Whenever the department finds it desirable to study a problem within a given State, harmonious relations and an intelligent understanding would undoubtedly be promoted by a consultation between the department and the State's station prior to its inauguration. In case a station is unable to cooperate in the work or does not desire to do so, it should lend sympathetic and advisory support.

(3) Unqualified approval is given to the proposal of the Secretary that in order to assist in the carrying out of the policy of cooperation there be organized a joint committee on correlation of research, to be made up of representatives from the department and the college and station association, one function of said committee to be the preparation for early publication by the department of a list of scientific projects to be undertaken by both the department and the stations. This committee should also be empowered to assist in any feasible way in correlating the work of the National and State research agencies in such manner as shall promote efficiency in securing results.

(4) Equally emphatic approval is given to the plan of holding group conferences between the scientific specialists of the department and the stations. It would seem desirable and perhaps necessary that owing to financial conditions within the association and stations the necessary expenses of such conferences should be met from a fund administered by the department.

(5) It seems to be mutually agreed that in order to make available to students of science the research work of the department and stations and to promote its standing in the scientific world there should be published by the department a journal of agricultural research, such journal to contain only those contributions from the department and stations as are viséed by the committee selected for that purpose.

EXTENSION.

The executive committee approves the policy of unifying the administration of the extension service and is desirous of assisting in securing Federal legislation to that end on the basis of the following principles and conditions:

(a) That the extension service shall be administered wholly under the immediate direction of the college of agriculture. State leaders of extension service shall be appointed by said colleges and shall be recognized as college officials.

(b) That extension-service projects maintained by Federal funds shall be entered upon only after mutual approval by the department and the colleges.

(c) That the funds to be applied to the maintenance of the extension service shall be secured through congressional appropriations made to the Federal department, to be distributed to the several States as provided by law, on the basis of the fundamental provisions embodied in the Lever bill (H. R. 1692).

(d) It is understood that the appropriations made for extension service by the several States shall be under their control.

(e) It is further understood that the (Federal) moneys appropriated to extension service shall all be expended under the plans and agreements mutually approved by the department and colleges, and that no outside cooperative arrangement for maintaining extension service shall be made with any corporation or commercial body, excepting as a corporation or commercial body may wish to donate funds to be administered in extension service exclusively by the colleges of agriculture in consultation with the department.

Carrying out the recommendations set forth in this memorandum, steps have been taken to organize several committees. The purpose of these committees will be to bring about closer relations with the State institutions and the department.

There will be a committee on relations, a committee on projects and correlation of work, and a committee on publication of research.

As a further result of the conferences and memorandum, the principles set forth with reference to extension have been embodied in a bill providing for such work, which was introduced by the Hon. Hoke Smith in the Senate and the Hon. Asbury F. Lever in the House. This bill, it is believed, will furnish the necessary machinery for bringing about the closest relationship between the department and the several States in the matter of extension service. It will enable the department to coordinate more clearly its work and so to handle it as to have the agricultural colleges as the means by which it is conducted.

PROPER ADMINISTRATION OF HATCH AND ADAMS ACTS.

In connection with the administration of the Hatch and Adams Acts, attention is called to another important matter which should have consideration. Efficient station work demands an atmosphere of fairness and justice and reasonable security to the staff. It furthermore requires stability of policy and the highest possible measure of continuity in work and in personnel. Money spent on discontinued or interrupted projects is usually very largely wasted. The director of the station, as the guiding head, is mainly responsible for the success of the station. A good station and a good director go together. The station director deserves to be sustained and supported by the governing board in carrying out the general policy after it is approved by them. A change in the director is inevitably a temporary shock to the work, often interrupts projects, causes changes in the policy and personnel, and creates an era of uncertainty; hence, a change is not justified except when clearly indicated by incompetence or inability. In the discharge of its functions in administering the Federal funds and in seeing that they are properly used, the Department of Agriculture should not fail to take cognizance of so important and vital a change as that of director.

The Adams Act directs that the Secretary of Agriculture shall each year ascertain and certify to the Secretary of the Treasury as to each State and Territory, whether it is complying with the provisions of this act and is entitled to receive a share of the annual appropriation. It authorizes the Secretary to withhold certification, thus suspending payment, and to report the matter to Congress. While the right of the colleges to direct the stations within their States and select the members of the station staff is recognized, radical changes in the personnel or policy of the station, except for good and valid reasons, should, it is believed, be held to be unwarranted interference of the governing board with the conduct of the station. Such action fails to recognize the cardinal principles of efficient administration and places an institution in a position of inability to properly employ the Federal funds. It is believed that such a condition does not warrant the Federal Government in continuing to advance funds to the college or its experiment station, and should lead to the withholding of funds until conditions favorable to their effective use are restored.

REVIEW OF ESTABLISHED WORK.

ADMINISTRATION OF THE NATIONAL FORESTS.

The largest task of the department in forestry is the administration of the national forests. The department is also developing the science of forestry and getting it into actual practice on private as well as public lands. This is being accomplished through demonstration of practical forestry on the national forests, cooperation with States in developing State forest organizations and assistance to States in protection of forests on the headwaters of navigable rivers, experimental work to determine the best methods of forestry, research in problems of utilization of forest products and saving of waste, and general educational work.

The primary objects of the national forests are to protect the public timber, to produce a continuous supply of timber on lands not required for agriculture, and to protect the sources of water used for navigation, irrigation, water power, domestic supplies, and other purposes.

Classification of Forests.

The department is classifying the national forest lands to segregate those chiefly valuable for agriculture and to establish permanent boundaries of the areas required for the production of timber and for water protection. Every consideration, not only of development of the States but of protecting and increasing the use of the resources of the forests, makes it desirable to further the agricultural development of land in the forests suited to farming.

The department is making rapid progress in the classification work and aims to segregate the larger bodies of agricultural land within two years. At the same time the establishment of the permanent boundaries of the areas to be used for forest production and protection of watersheds will enable the concentration of the expenditures in protection, improvements, and reforestation where they will yield permanent results.

Similar work should be done outside the national forests. Public lands valuable only for forest purposes—that is, for growing timber and protecting water flow—are now exposed to fire and trespass and often endanger the forests under protection. Legislation is called for to provide that these lands be classified and added to the national forests.

Business Aspects.

In administering the national forests the department is handling a very large business enterprise. The forests will be made self-supporting as rapidly as possible. Earnings are increasing. The increase for 1913 over 1912 was over \$300,000, or 15 per cent. Many forests already return more than their operating cost, and their number will rapidly grow under the present vigorous timber-sale policy. Most of the timber is still far from a market, often requiring the construction of from 20 to 75 miles of railroad by purchasers. With improved conditions the heavily timbered forests will soon yield returns sufficient to meet the deficit on forests held primarily for watershed protection.

Fire Protection.

The first great task is to protect the forests from injury and destruction by fire. The inflammability of the forests, the long dry seasons, the lack of means of transportation and communication, and the carelessness of many individuals make this work peculiarly difficult. From 2,000 to 3,000 fires a year are started on the forests. Our efforts must be to reduce the number by removing all preventable causes of fire, and to be equipped to handle promptly every fire that starts. The timber alone is worth about \$1,000,000,000. The money spent on protection, a little over 2 cents an acre, is cheap insurance.

The Timber Policy.

The national forests must be made to grow all the timber that they can; they must supply the needs of the public at as low cost to the public as possible; and they must be so managed as to protect the public against timber monopoly through private control of stumpage or of the manufacture of lumber.

Full production means that lands now unstocked or partially stocked must be reforested and that those now covered by a mature

stand must be cut over, with provision for the starting of a new crop. The most pressing immediate need is, next to fire protection, which both safeguards the present stand and promotes reforestation on a great scale, the working over of forests where most of the crop is ripe. Sales of timber are being aggressively pushed and the cut is rising yearly. The timber is sold on terms and conditions which safeguard the public against the evils of speculation and monopoly. Full value for the public timber sold for commercial use is obtained and must be obtained if the Government is not to subsidize those business enterprises which buy the timber.

The Grazing Policy.

The objects of regulated use of the range for grazing are full use of the resource without injury to timber growth and water flow, the encouragement of the live-stock industry, and healthy upbuilding of the West through widely diffused participation in the range privilege by small owners. The success which has been attained in restoring the productivity of ranges depleted by the unregulated competition of former days, in working out methods of use satisfactory both to the stock industry and to the public, in making new range available and learning how to use all kinds of range to best advantage, and in developing the industry along lines which contribute to home building and diffuse prosperity shows what true conservation means.

Water Power.

There are very great power possibilities within the national forests. Already there are 76 developed projects and 30 under construction. As the market for power increases there will be a much greater demand than at present, and the Government should make the power sites available under terms which will not only encourage the investment of capital but fully insure the interests of the public. The chief defect of the present law, under which the department is working, is the statutory provision permitting the granting only of a revocable franchise. This law should be changed to allow for the use of land for power purposes, with such provisions as may be needed to protect the investor and the using public.

Miscellaneous Uses.

No use of the forests by the public should be refused if some more important use is not at stake. On the contrary, these 167,000,000 acres of our country should be made to yield the largest net total of benefits that can be got out of them. The land can be occupied and is being occupied for a great variety of purposes by a multitude of individuals. When the object sought involves an exclusive privilege, a special-use permit is issued. More than 15,000 such permits are in force. A vastly greater number of persons visit the forests

for purposes which require no permit, such as camping, fishing, hunting, prospecting, and similar objects. The number of such persons last year exceeded 1,500,000.

Recreational use of the forests is already of very great importance, and will be much greater a few years hence than it is now. The value of the forests as playgrounds must be recognized and so provided for that the public will always find full opportunity open for such use. To the extent that the law permits, this is being done. Full development of recreation use calls for legislation to permit the department to grant term permits for the occupancy of land for the construction of hotels, summer cottages, and similar purposes, as permits may now be granted for the development of mineral springs.

Recreation use of the forests must be surrounded with safeguards to keep the water supplies of cities uncontaminated, and must be controlled to the extent which the preservation of natural beauty against vandalism and unsightly conditions involves. As public playgrounds the national forests will increasingly have a value for the people of the country, the importance of which it is impossible to overstate. As protectors of water supplies for domestic use their value will also steadily rise. Already over 1,200 cities and towns draw their supplies from national forest watersheds. Protection both of regularity and of purity of such supplies is an imperative public duty. There is lacking at present adequate authority to prevent water contamination by campers, prospectors, and others. Legislation to enable the department to cooperate with cities and towns in safeguarding the public health through sanitary regulation of the use of watersheds is an urgent need.

IMPROVED HIGHWAYS.

There has been a steady movement for better roads during the past 20 years, with the result that to-day about 24 States have highway commissions or some other State highway agency. A few of these are engaged in educational work, but most of them are expending State money in the construction and maintenance of roads. So rapid has been the growth of this work that, while the total annual expenditure of the States for this purpose amounted to but \$2,000,000 10 years ago, it has grown to \$43,000,000 in 1912. The results are in evidence in the form of thousands of miles of well-constructed roads in the States which have been most liberal in providing State funds, in a higher standard of supervision, and in more strict accounting for the financial handling of the work.

Federal Aid in Road Building.

With the growing interest in road construction and road maintenance it becomes evident that the relation of the Federal Govern-

ment to this work should be defined. It is believed that the Federal Government should take the lead in investigational and experimental work, having for its object the securing of facts necessary for the most economical methods of road building and road maintenance under the widely varying conditions existing in the United States. There is need for a central agency which can do the highest type of investigational work and can furnish the best information on all problems of road construction and road maintenance—an agency, in short, which shall be able to say the last word on matters pertaining to the construction and maintenance of roads and to road administration. The department has laboratories for testing and research work, issues numerous publications of an educational character, and employs a group of the best highway and engineer experts obtainable. It has actively aided the States and communities with suggestions or advice and has made demonstrations of its methods as opportunity has offered. The function of the department has heretofore been primarily educational, and as such it has been recognized to be of great value.

Improvement of Post Roads.

Recently Congress took a step of great importance and significance. Under conditions specified it made an appropriation of a half million dollars, "to be expended by the Secretary of Agriculture in cooperation with the Postmaster General in improving the condition of roads to be selected by them over which rural delivery is or may hereafter be established," and provided that such improvements should be made under the supervision of the Secretary of Agriculture. It made this appropriation contingent on the appropriation of double the amount of money for such improvement by the State or the local subdivision thereof in which such improvement was to be made. As the regular appropriation for the Office of Public Roads is approximately \$300,000, it will be seen that the Department of Agriculture has been charged with the supervision of an expenditure for roads of about one and three-quarter million dollars. The time has been too short to determine fully the value of the experiment authorized by Congress, and it has been recommended that it be continued with an increased appropriation.

Cooperation With the States.

The principle of cooperation with the States embodied in the action of Congress referred to is undoubtedly a helpful and wise one. It has heretofore characterized the relations of the department with the States in its educational or demonstrational work. It is believed that if Federal aid is to be further extended in the construction and maintenance of highways any legislation to that end should incorporate this principle. It seems desirable that the Federal Govern-

ment should deal with the State as the lowest unit through an expert highway commission as its agency. This policy would eliminate the difficulties of the Federal Government in determining local issues, as well as the danger of undue centralized Government control. In order to stimulate self-help and to prevent undue inroads on the Federal Treasury, wherever Federal aid is extended for construction and maintenance it should be furnished on condition that the States provide an appropriation at least double that voted by the Federal Government. This would furnish an automatic check. The plans should probably provide for maintenance as well as construction, in order to prevent the possibility of the construction of roads many of which may wear out before the bonds placed upon them are paid. What roads should be improved is a matter of great moment. Unmistakably the roads of greatest economic and social importance are those over which the products from the farms can be taken to the nearest railway station and which minister to the other economic and social needs of the community. It would be desirable that no Federal funds should be expended on any project until a scheme of road construction and maintenance within a State had been developed and previously agreed upon by the proper representatives of the State and of the Federal Government. That any money which may be appropriated by the Federal Government should be apportioned on the basis of a number of factors—such as total population, farm population, area, taxable valuation, and mileage—needs no detailed comment.

LEGAL WORK.

Expansion of the department's field of activity during the year has resulted in a material increase in the legal work of the department, both in advice upon fundamental questions underlying the administration of recent acts of Congress and in the preparation of cases for report to the Attorney General under the penal provisions of these statutes.

The provision of the agricultural appropriation act for the fiscal year 1914 regulating interstate and foreign commerce in worthless, contaminated, dangerous, and harmful viruses, serums, toxins, and analogous products and committing to the Secretary of Agriculture the administration of the act adds another statute in the execution of which important legal questions arise.

Arrangements were perfected during the year for a more expeditious and economical handling of the criminal cases under the food and drugs act and under the insecticide act.

There were transmitted to the Department of Justice 1,048 cases—652 for criminal prosecution and 396 for seizure of goods under section 10. Twelve hundred and fifty cases, including some reported in

previous years, were terminated during the year—848 criminal and 402 civil. Fines amounting to \$23,463.50 were imposed in 596 of the criminal cases, and decrees of condemnation and forfeiture were entered in 365. The courts have evinced a disposition to impose severer penalties for violations of this act than in the past. Eight hundred and sixty-seven notices of judgment were prepared.

In cooperation with the Interior Department 1,184 cases involving claims to lands within the national forests under the homestead, timber and stone, mineral, lieu selection, and other general and special land laws of the United States were handled. As a result of the adjudication of a part of these cases 73,000 acres of valuable timbered lands were retained in the forests.

Four hundred and thirty-six cases of trespass on national forests were handled, resulting in the payment into the Treasury of the United States of \$27,764.91.

As in previous years, the enforcement of the 28-hour law has proceeded vigorously and effectively. There were reported to the Attorney General 1,037 apparent violations of the statute, 406 more than in the previous fiscal year. Penalties aggregating \$61,695 were recovered.

The Court of Appeals for the Second Circuit has held that connecting carriers are bound to make reasonable inquiry as to the length of time live stock have been previously confined in cars without food, rest, and water. This ruling will have a marked effect in the attainment of the purposes of the act.

The department reported to the Attorney General 92 apparent violations of these laws. In 93 cases, including some reported in the previous year, fines aggregating \$10,275 were imposed.

The department reported 81 apparent violations of the meat-inspection law to the Attorney General. Convictions were secured in 64 cases, including a few reported in the previous year, resulting in the assessment of fines to the amount of \$3,315. In seven cases sentences of imprisonment from 3 to 30 days were imposed.

Increased activity of the department in the matter of enforcing those provisions of the Penal Code regulating interstate commerce in game and wild birds resulted in the submission to the Attorney General of 154 cases, 73 of which resulted in convictions and fines amounting to \$3,557.

ENFORCEMENT OF THE INSECTICIDE ACT.

In the enforcement of the insecticide act the department has to do with two classes of insecticides, lead arsenates, Paris greens, and fungicides: First, those which enter interstate commerce or are sold or manufactured within the District of Columbia or the Territories;

and second, those offered for import into the United States at its various ports of entry.

The analyses and testing of official samples and the investigational work necessary to be undertaken have two general objects in view: (1) To secure data on which to base an action under the insecticide act; (2) to develop scientific information with a view to assisting manufacturers in respect to process of manufacture, packing, labeling, and shipping their products so that they will be in harmony with the law.

Efficient enforcement of the act is being obtained by means of prosecutions, and through hearings and correspondence many minor faults in labels have been adjusted without resort to the courts. Signal service has been rendered manufacturers of insecticides, Paris greens, lead arsenates, and fungicides in bringing to their attention scientific information relative to correcting faulty methods of manufacture, faulty methods of analysis, and faulty methods of test, thereby aiding them to place better products on the market, with more correct labels and of more certain standard.

THE FEDERAL LAW PROTECTING MIGRATORY BIRDS.

The act of Congress of March 4, 1913, authorized the department to adopt suitable regulations and to fix close seasons for migratory game and insectivorous birds according to zones. The preparation of the regulations was intrusted to a committee of three members of the Biological Survey, and after due publication the regulations were adopted and approved by the President on October 1. Under these regulations two zones were established and five forms of close seasons prescribed—a daily close season extending from sunset to sunrise for all migratory birds; an annual close season of $8\frac{1}{2}$ or 9 months for game birds; a 5-year close season for certain game birds in danger of extermination; a perpetual close season for insectivorous birds; and a perpetual close season for birds on two of the great navigable rivers.

The reception of these regulations by the public has been very gratifying. Except in a few localities they have been welcomed. The chief objections have been to the prohibition of shooting after sunset and of hunting on the Mississippi and Missouri Rivers. Their effect has been to standardize the seasons for hunting, to crystallize public sentiment against spring shooting and in favor of a reasonable open season in autumn, and to arouse general interest in the protection of our migratory birds.

The enforcement of the law presents problems even more novel and difficult than the preparation of the regulations. On account of the limited appropriation made by Congress, it is necessary to depend chiefly on cooperation with local authorities. The United States has been divided into 13 districts, each of which will be in charge of an

experienced inspector and a limited force of wardens. The inspectors are employed by the department, and the wardens are selected from experienced men on the State forces, but receive only a nominal salary from the department. Through cooperation with other branches of the Federal service and with local authorities much may be accomplished. In the few weeks that the regulations have been in effect the field force has been partially organized in half of the districts, and some interesting results have already been obtained.

FEDERAL PLANT QUARANTINE ACT.

The purpose of the Federal quarantine act of August 20, 1912, is to enable the Secretary of Agriculture to regulate the importation of nursery stock and other plants and plant products, and to enable him to establish and maintain quarantine districts for plant diseases and insect pests and to quarantine against diseased or insect-infested plants or plant products of foreign countries. The act is being effectively administered by a Federal horticultural board appointed from the Bureaus of Entomology and Plant Industry and the Forest Service of this department, in cooperation with the State, Treasury, and Post Office Departments and with horticultural inspectors of the several States.

All nursery stock offered for entry into the United States comes under two classes: (1) That from countries having an official inspection and certification system and from which commercial importations are permitted, and (2) that from countries which have no system of inspection and certification and from which importations are limited as to amount and permitted only for experimental or scientific purposes. The examination, certification, and other conditions governing importations are now well understood by importers. The Federal act has greatly stimulated foreign countries to do better inspection and to provide suitable legislation to meet our requirements. The result of this is now evident in the much greater freedom from infestation or disease of nursery stock offered for entry. Few instances of serious infestation have been found during the year, which is a marked contrast with conditions prior to the enactment of this legislation.

Under the provisions of the act permitting foreign quarantines four have been promulgated—against the white-pine blister rust of Europe and Asia, the potato wart of portions of Canada and several European countries, the Mexican fruit fly of Mexico, and the pink boll worm of cotton of Egypt.

Under the provisions of the act providing for domestic quarantines four have been promulgated—against the Mediterranean fruit fly in Hawaii, the gipsy and brown-tail moths in New England, the date-palm scale insects in certain counties of California, Arizona, and

Texas, and the pink boll worm of cotton in Hawaii. These domestic quarantines provide for the movement of the quarantined articles under a system of inspection and certification, necessitating a considerable force of inspectors, particularly in the case of the Mediterranean fruit fly and the gipsy moth and brown-tail moth quarantines. The State inspection service of California and the inspection service in New England under the appropriation for moth control have been used in cooperation with this department for the effective enforcement of these two quarantines.

CONSTRUCTIVE RESEARCH AND DEMONSTRATION WORK IN CROP PRODUCTION.

The constructive research and demonstration work bearing directly upon practical agriculture comprises activities that are exceedingly numerous and widely varied in character. There is practically no regulatory work to divert attention from the problems which are of direct and immediate importance to the farmer.

Crown-Gall of Plants.

Among the distinct achievements in the pathological field is the staining of the crown-gall organism in the tissues of the crown-gall tumor, which is the conspicuous symptom of this widespread and destructive disease which attacks a very wide range of crop plants. Important and significant results have also been obtained with regard to the relation of the crown-gall organism to animal tumors, which it is believed will be helpful to investigators of cancer in man and the lower animals.

As the result of an incidental investigation made in China by one of our agricultural explorers under instructions from the forest pathologist, it has been definitely established that the destructive chestnut-bark disease which is causing so much damage to the chestnut forests in the eastern United States was in all probability brought to eastern America from the Orient.

Potato Diseases.

The prevalence to a destructive extent of several new diseases of the potato has greatly disturbed the potato industry in some of the most important potato-producing districts of the Rocky Mountain region. The leaf-roll, curly-dwarf, rosette, and mosaic diseases which were until recently unknown in this country are receiving the attention of the pathologists in charge of this line of work.

Artificial Ripening of Dates.

It has been proved that the artificial ripening of dates can be effectively and cheaply done by merely subjecting the full-grown, though immature, fruit to a warm and humid atmosphere. This discovery of a simple, effective, and inexpensive method of ripening has greatly simplified the profitable production of some of the choice

varieties, such as Deglet Noor, which do not come to full maturity on the tree in the date orchards of the Southwest. An improved method of rooting small date offshoots has been sufficiently developed to indicate that the propagation of choice varieties of dates can be much accelerated, with the result that in future when choice varieties are introduced or originated stock of them can be made available to planters in much less time than is possible with the Old World methods.

Cotton and Corn Standards.

The increased demand from the public for sets of cotton grades indicates a marked increase of interest in cotton grade standardization. The importance to all legitimate interests of accomplishing as early as possible the universal adoption and use of uniform standards has become clearly evident.

As a result of the studies conducted for several years in connection with the marketing, handling, transporting, storing, and grading of grain, tentative grades for commercial corn have been formulated. Both producers and dealers have recently shown much interest in the subject, and it is believed that the general adoption and use of uniform grades in both our domestic and export trade would constitute a long and important step forward in American agriculture.

Foreign Plant Introduction and Exploration.

Agricultural exploration work has been vigorously prosecuted during the year in Siberia and northern China, where search is being made for trees and plants capable of enduring low temperatures and light rainfall. A preliminary exploration of the regions in western South America has been made. This has resulted in the securing of a unique collection of potatoes, which includes some varieties likely to be of distinct value in potato breeding.

Farm Management Investigations.

Important results have been obtained in the study of the cost of producing farm products, the factors which affect the profitability of farm enterprises, and the best way of organizing these enterprises so as to obtain the greatest net income. These studies have also made possible the devising of suitable methods of farm cost accounting for farmers' use. Survey records on over 2,000 farms have been secured which give a complete analysis of the farmer's business and show the relative efficiency of labor under different farm conditions.

The systematic study of the organization of farms and of individual farm enterprises has brought a more intimate knowledge of the detailed practices and the limiting factors governing these

practices in the farm business, and has made it possible to meet with greater efficiency the increasing demand for plans and specifications for the organization and administration of farms.

Farm Demonstration.

The effort to aid the farmer through the demonstration method to improve his practice by adopting better methods has received increased attention.

Some of the most effective and most conspicuous results are found in the boys' demonstration work in the South, where 480 members of the boys' corn clubs in the various Southern States produced yields of over 100 bushels of corn to the acre. The work of the canning and poultry clubs, through which the girls of the farm are encouraged to preserve in a form suitable for home use or sale such products as tomatoes and other vegetables and fruits as can be profitably produced for local consumption, on many farms has yielded very satisfactory results.

In the Northern States a good beginning has been made in farm demonstration work during the year. This work is prosecuted for the most part in cooperation with the agricultural colleges through county agents, who devote their entire time to the study of local agricultural conditions and needs and act as counselors and advisers to farmers, encouraging the adoption of improved methods and where advisable the introduction of new crops. While the organization and establishment of this work in the North and West is too recent to indicate in any very definite way what may be expected to result from it, a summary of the work of the agents in the 30 counties longest established discloses that more than 6,500 farms have been visited and more than 1,800 farmers' meetings addressed, with an attendance exceeding 130,000. Cooperative work has been carried on directly with nearly 2,400 farmers, many of whom are being encouraged to select and test carefully their seed corn. More than 235,000 acres of corn have been planted with tested seed. Several hundred farmers are following instructions in the growing of alfalfa, clover, and potatoes, and much orchard pruning and spraying have been done as a result of the advice and instruction of the agents. These agents have made plans for the operation of nearly 200 farms, and have organized 65 farmers' clubs, with a membership of nearly 1,500 farmers.

In the boys' and girls' club work in the North and West, six State cooperative agents have been employed, who have had the assistance of five collaborators in the conduct of club work. The present enrollment in this work amounts to about 60,000 boys and girls, who are systematically organized into boys' corn clubs, girls' canning clubs, potato clubs, sugar-beet clubs, vegetable-garden clubs, etc. The aver-

age yield per acre of all the corn-club members reporting this year was 74.5 bushels, with a net profit of \$25.55 per acre; 426 made 100 bushels or more, and 1,078 made over 60 bushels per acre.

Seed Distribution.

The distribution of drought-resistant field seeds in the Great Plains area and other dry-land sections of the country has apparently been productive of excellent results. This distribution, which consisted of improved varieties and strains of field crops adapted to the regions of light rainfall, was made in such a way as to provide the farmer with seeds sufficient for an area—usually an acre—adequate to make a practical test of the adaptability of the crop to his conditions. Should it prove superior to the one he is already growing, his initial harvest in most cases will provide him a sufficient supply of seed for a considerable acreage the next year. The beneficial results from this distribution of such field seeds as alfalfa, feterita, kafir, milo, millet, Sudan grass, and other forage crops, and certain cereals suggest the advisability of radically changing the seed distribution so as to accomplish the purpose for which it was originally established, namely, the introduction into practical farming of new and valuable crops needed in the improvement and development of agriculture.

ANIMAL DISEASES, ANIMAL HUSBANDRY, AND DAIRYING.

The department is working in various ways to foster and promote stock raising and to encourage the production of a sufficient and wholesome supply of animal food for the people.

In the control and eradication of animal diseases the department is working in cooperation with State and local authorities. After 15 years of effort sheep scab, which was formerly prevalent throughout the West, has been so nearly eradicated that only a few comparatively small areas remain in quarantine. The stamping out of cattle mange has likewise been nearly completed.

Tick Eradication.

The greatest undertaking of this character has been the extermination in the South of the ticks which spread the disease of cattle known as Texas fever. Until recent years the southern part of the United States has been under the blight of these ticks, the infected area extending from Virginia to Texas and including southern California. After seven years of effort more than one-fourth of the territory originally infected has been freed from ticks and released from quarantine, and the work is being pushed vigorously and with good progress in much of the remaining area. The territory released now amounts to 196,395 square miles, being greater than the combined areas of South Carolina, Georgia, Alabama, and Mississippi. At first this work was done against some opposition because of the lack

of knowledge of its benefits, but the purposes and advantages are now so well understood that it is meeting with the hearty cooperation of the people of the affected region. The most effective means of destroying the ticks is by dipping the cattle in an arsenical solution. The success of this work is now only a matter of time and money, and with adequate appropriations the extermination of the ticks can be completed before many more years have passed. When this is accomplished a large area which has heretofore produced only a small proportion of what it is capable of raising under favorable conditions will become available for beef growing.

The Foreign Meat Situation.

In anticipation of the increased entry of foreign meat, the department dispatched two of its specialists, one to South America and the other to Australia (the principal sources of probable imports), to ascertain whether the Governments there maintain adequate supervision of their meat industries. The purpose was to safeguard our people from foreign meat that might be a carrier of disease or that might have been slaughtered under conditions that would not be permitted in the United States. The only countries of South America that are in a position at the present time to ship meats to the United States are Argentina and Uruguay. Both of these countries are conducting a Federal inspection by veterinarians of all animals slaughtered for meat which is intended for export. The inspection is quite competent. There are some minor differences between the systems of inspection there and in the United States, but on the whole the inspection is planned largely after that conducted here, and these minor differences will be overcome. A report on Australia has not yet been received. Rigid regulations governing the admission of foreign meat and meat products have been established and are being effectively enforced.

Dairying.

The department is also working for the increase and improvement of the supply of milk and other dairy products, both by means of research and by the dissemination of information.

Within the past year noteworthy results have been obtained in the research laboratories with regard to certain problems connected with the pasteurization of milk, on the cause of deterioration of storage butter, on the causes of flavor in cheese, and with regard to other facts relating to the bacteriology and chemistry of milk, butter, and cheese.

NEW METHODS OF INSECT CONTROL.

The efforts of the department in the matter of insect control have been marked by the discovery of new methods in the handling of the gipsy-moth problem in the forests of New England and by a very satisfactory increase and spread of the introduced foreign parasites

of the gipsy moth and brown-tail moth. Further field experiments of a thoroughly practical nature in the control of the alfalfa weevil, an insect which has threatened enormous losses in the West, have shown such good results that alfalfa growers in the infested territory have secured a fairly good crop of hay throughout the season, while some of the best alfalfa growers in that part of the country now insist that they can secure a larger annual yield than they were able to do before the pest appeared. Demonstrations of the possibility of control of the destructive bark beetles of the western forests have shown that threatened outbreaks can be suppressed in an almost perfect manner and at extremely little cost. The threatened introduction of the Mediterranean fruit fly from Hawaii into the Western States has received careful attention, and at the present time measures are in force which will probably effectually protect the fruit industry of the Pacific States from this pest.

AGRICULTURAL EXPERIMENT STATIONS.

The States have in recent years greatly increased the appropriations to these stations to supplement the Federal funds. The total income of the stations in 1912 was \$4,068,240, of which \$1,440,000 was received from the National Government. In the same year \$1,000,000 was expended for buildings for the stations and about \$500,000 for permanent equipment.

The Insular Stations.

Gratifying success has been attained in the growing of cereals and vegetables in various parts of Alaska, and the evidence accumulates that there may be considerable agricultural development in that Territory whenever better transportation facilities and the broader utilization of its other natural resources bring in sufficient population to give a reliable market for the products of the soil.

In Hawaii a soil survey is nearing completion and local agricultural industries have been encouraged through the results of scientific investigations, demonstration farms, and associations for cooperative marketing.

The Porto Rico station is giving special attention to the utilization of lands which are unprofitable under the present systems of cultivation. Efforts to aid in the development of the citrus industry are being continued. In 10 years the annual exports of citrus fruits have increased in value from \$230,000 to more than \$1,100,000. Coffee is receiving much attention, and it has been shown that by better methods of cultivation and fertilizing the crops can be more than doubled.

In Guam there is increased interest in agriculture on the part of the natives as the result of the station's work. Efforts are being made to improve the live stock of the island by the introduction of pure-

bred stock. A large number of tropical and subtropical fruits, vegetables, and forage plants are being tested.

IRRIGATION AND DRAINAGE.

The studies of irrigation methods and appliances now carried on in all the irrigated regions and in a number of the humid States are bringing information which will enable the farmers to reduce greatly the waste of water and thus extend the benefits of irrigation to a much larger area. The securing of competent settlers on the great areas of land in the West now coming under the ditch is still the most urgent problem in that region. The department is therefore doing all it can to bring to the actual or intending settlers who are unacquainted with irrigation practices such information as will enable them to undertake this work with success.

Examinations and surveys of about a million acres of land needing drainage have been included in the work of the department during the past year. In this way interest in drainage reclamation is being stimulated over wide areas.

AGRICULTURAL EDUCATION.

The rapid development of agricultural education in the United States, which has been so marked a feature of recent educational progress, is continuing. This has been especially apparent during the past year in the better support given to the agricultural colleges, in the establishment of additional agricultural courses in universities and colleges of private foundation, in the increasing number of States giving financial aid to secondary instruction in agriculture, in the attention given to the training of teachers of agriculture for secondary and elementary schools, in the larger attendance of students at all sorts of colleges and schools in which agriculture is taught, and in the great popularity of certain forms of elementary instruction in agriculture, such as children's gardens in cities, boys' corn clubs, girls' garden and canning clubs, and other juvenile agricultural-club work.

The department has continued to maintain a center of information on the various phases of this broad educational movement.

THE CROP OUTLOOK.

This statement as to crop yields is in a large measure an estimate. This fact should be constantly kept in mind in connection with the summary here submitted.

CROPS IN THE UNITED STATES.

From the best information at hand it appears that the production of crops in the United States in 1913 was materially below the average, the yield per acre of all crops combined being smaller than in

any year of the past decade, with the exception of 1911. This shortage was caused by a severe drought, accompanied by excessive heat during the summer months, in an important portion of the agricultural district of the United States, and particularly in Kansas, Oklahoma, Missouri, and adjacent States.

Inasmuch as crop production in 1912 was unusually large, a greater proportion than usual has been carried into the present crop year, which should mitigate somewhat the effects of the shortage of this year's crops.

The corn crop, the most valuable farm product of this country according to the estimates, fell below 2,500,000,000 bushels, which is smaller than any crop since 1903 and about 660,000,000 bushels smaller than the record crop of 1912. The estimated yield is 23 bushels, compared with a yield of 29 bushels in 1912 and an average yield of about 27 bushels. In only 9 of the past 47 years has the yield per acre been less than 23 bushels.

Wheat production, with an estimated total of 753,000,000 bushels, notwithstanding the general crop shortage, is the largest ever recorded in this country. The crop was practically matured before the drought became effective. The largest previous estimate was for 1901 (like this year, a short-crop year), with 748,000,000 bushels. The production in 1912 was estimated at 730,000,000 bushels. In yield per acre, this year's estimate of 15.2 bushels has been exceeded five times in the past 47 years. The estimated average yield for the past 10 years was 14.2 bushels.

The oat crop, estimated at 1,122,000,000 bushels, although nearly 300,000,000 bushels smaller than last year's record crop, is the third largest in our history, the crop of 1910 holding second place. There has been a steady expansion of area in this crop. The yield per acre, however, was slightly below the 10-year average.

The hay crop, estimated at 63,460,000 tons of cultivated hay, is nearly 13 per cent smaller than the large crop of 1912. In yield per acre the estimate is 1.31 tons, compared with a 10-year average of 1.43 tons. The lowest yield per acre in the past decade was 1.10 tons in 1911, and the highest 1.54 tons in 1903 and 1905. Rather liberal rains in the late summer and fall have produced good pastures.

The production of cotton has not yet been estimated. Present indications are that the yield per acre will be slightly below the average; but, as the acreage is large the total production, which will probably exceed 13,000,000 bales, will rank perhaps fourth or third in size.

The acreage devoted to the five crops mentioned—corn, wheat, oats, hay, and cotton—comprises about 90 per cent of the area in all crops, and therefore has a predominating effect upon the general average condition of all crops. Nearly all of the minor crops were materi-

ally smaller this year than in 1912, and the per acre yields below their average. The potato crop is estimated at 328,000,000 bushels, as compared with 420,000,000; tobacco, 903,000,000 pounds, compared with 963,000,000; barley, 173,000,000 bushels, compared with 224,000,000; rye, 35,000,000 bushels, compared with 36,000,000; flaxseed, 19,000,000 bushels, compared with 28,000,000; buckwheat, 14,000,000 bushels, compared with 19,000,000; sweet potatoes, 56,000,000 bushels, compared with 55,000,000—in each case comparison being with 1912.

The yields per acre of all crops combined compared with their 10-year average yields in those States which fared most favorably in crop production this year were, if 100 is taken to represent the average: Arizona, 116; Minnesota, 115; Florida, 111; Wisconsin, 110; Virginia, 107; South Carolina, 106; Nevada, 105; Oregon, 105; Georgia, 104; and North Carolina, 104.

Similarly, the yields per acre of all crops combined compared with their 10-year average yields in those States which suffered most severely in shortage were, on the same basis: Kansas, 61; Oklahoma, 62; Missouri, 71; Nebraska, 78; Illinois, 80; South Dakota, 82; Kentucky, 83; New Mexico, 84; Tennessee, 88; and California, 88 (the shortage in California is due largely to a freeze of exceptional severity to citrus crops and to drought in the spring of 1913).

To the producers the lessened crop production this year is largely compensated by the increased prices received for their produce; for, although the total crop production is approximately 12 per cent smaller than last year's production, the average level of prices of crops on November 1 is about 13 per cent higher than last year.

CROPS OF THE WORLD.

Distinctive features of "world" crops in 1913 as compared with 1912 are increased areas sown to wheat, oats, barley, rye, and corn. The wheat acreage has probably yielded a record outturn; barley, oats, and rye are bountiful crops, but corn will probably give the poorest result in 20 years. Comprehensive figures for all countries are not available, but the 12 countries which ordinarily produce over 80 per cent of the world's wheat crop have officially returned their aggregate acreages in 1913 compared with 1912 as follows: Wheat, 240,622,000 against 236,685,000 acres; oats, 123,235,000 against 119,027,000 acres; barley, 50,830,000 against 48,219,000 acres; and rye, 97,516,000 against 95,293,000 acres. The increase in the wheat area was almost exclusively in the United States and the Russian Empire; cultivation retrograded notably only in Hungary, Roumania, and British India, due chiefly to meteorological causes.

The wheat yields of the 12 countries in 1913 aggregated 3,398,638,000 bushels, compared with 3,259,600,000 bushels in 1912. The estimated increase of over 150,000,000 bushels in the yield of these

countries this season, if finally realized, indicates that the 1913 world crop will surpass all previous records, the total yield of 1912 (3,764,000,000 bushels) having been the maximum up to that date.

The 1913 world oat crop, though not a record, will rank among the largest ever grown. The yield in 1912 totaled 4,582,000,000 bushels, of which the 12 countries produced 3,750,000,000 bushels. Preliminary official estimates make the outturn of the 12 countries for the present season 3,629,000,000 bushels, the shortage being entirely in the United States.

A noteworthy feature of the rye crop of the countries in question is the deficiency in 1913 of the principal rye-producing country, Russia, which reports a crop of only 895,000,000 bushels against 1,044,000,000 bushels in 1912. In the German Empire, the other principal rye-producing country, the returns indicate a yield in Prussia alone of 375,512,000 bushels, or a 44,000,000-bushel increase over the crop of the preceding season. Increased outturns in other countries are likely to counteract the shortage in Russia.

Preliminary estimates of the 1913 output of barley in such of the 12 countries as report upon this crop aggregate 1,009,821,000 against 1,031,897,000 last year. There is a deficiency, compared with the previous year, of 50,000,000 bushels in the United States and a slight falling off in Prussia, but an increase in the yields of Russia, Hungary, Spain, and France.

The tremendous shortage in the 1913 world corn crop, consequent upon a crop failure in parts of the United States, is coincident with deficient yields in Russia. In other countries of southern Europe the prospect is for a bounteous harvest.

SUMMARY OF THE MORE IMPORTANT FEATURES.

When the Department of Agriculture was first organized, and for many years thereafter, its work was confined to matters directly affecting agriculture. Congress has, however, more recently enacted legislation charging the department with the enforcement of numerous regulatory laws, including those relating to meat inspection, animal and plant quarantine, food and drugs, game and migratory birds, seed adulteration, insecticides, fungicides, etc., many of which only indirectly affect agriculture. Its activities, therefore, now concern, directly or indirectly, all the people.

To carry on the work of the department during the last fiscal year, Congress appropriated \$16,651,496 for ordinary expenses, in addition to which permanent annual appropriations, special appropriations, and balances from previous years amounting to \$8,303,412.68 were available, making a total of \$24,954,908.68. The total of funds which has been or will be returned to the Treasury, together

with miscellaneous receipts, aggregate \$3,132,303.82. Of this amount there was received from the sale of timber, grazing permits, condemned property, etc., \$2,449,287.66, which has been deposited in the Treasury. About three-fifths of the appropriation, or about \$15,000,000, was expended for regulatory work, and the remainder, or about \$9,000,000, for scientific research, experiments, and demonstrations directly affecting the farmer.

An important change in the system of handling the financial affairs of the department was effected toward the close of the year, which is very satisfactory and results in a saving of time and money.

Several changes in the organization of the department have been effected with the object of developing more complete coordination of the work of the several bureaus and between the department and other Federal departments and State and other agencies interested in agricultural development.

The Weather Bureau stations and substations will undergo gradual reorganization and elimination; this bureau will cooperate with the Hydrographic Office in the publication of various meteorological charts; the research work at Mount Weather will be discontinued and only climatological records made there; the bureau will give more attention to special crop warnings and the forecast service and will include in its scientific work studies of storms, hurricanes, frosts, and cold waves.

The soil-survey work has been made more valuable by the establishment of cooperation with the States, including their experiment stations, colleges, and agricultural bureaus. The department will give precedence in conducting soil surveys to those States which cooperate with it. During the year 19 States have appropriated money for soil surveys under the new plan of cooperation.

The decision of the Attorney General and subsequent action of the Secretaries of the Treasury and Commerce in rescinding Regulation 39 placed meats and meat products under the pure-food law. This necessitated new machinery and some reorganization in the Bureau of Chemistry and made necessary close cooperation with the Bureau of Animal Industry. The general effect was to give the Federal Government control over meat and meat products in interstate commerce and in all stages of transit instead of restricting its jurisdiction to the Federal-inspected meat establishments. Other changes in the bureau are designed to coordinate and improve its work, including the establishment of food and drug standards.

The new fields of work upon which the department has entered include the study of marketing farm products, rural organization, rural credits, rural hygiene and sanitation, the condition of woman on the farm, the popularization of the department's work, and the de-

velopment of closer relations with the State agricultural institutions along the lines of the plan submitted to the executive committee of the Association of Agricultural Colleges and Experiment Stations at its recent meeting in this city.

The national forests are rapidly being made self-supporting, many of them already returning more than the operating cost. There are great power possibilities within the national forests, 76 projects being already developed and 30 under construction. As the market for power increases, there will be a much greater demand, and the Government should make power sites available under such terms as will encourage the investment of capital and fully insure the interests of the public. The recreational use of forests should be encouraged.

The trend of the movement for better roads is in the direction of State and Federal participation, and to-day 34 States have some form of highway commission.

The department is cooperating with the Postmaster General in the improvement of selected roads, for which Congress appropriated \$500,000 conditioned upon the raising of double that amount by the States in which such roads are located. Construction is now under way on some of these roads.

Fines aggregating \$23,463.50 were imposed in 596 cases for violations of the food and drugs act; there were 436 cases of trespass on the national forests, the fines for which amounted to \$27,764.91; penalties amounting to \$61,695 were recovered for violations of the 28-hour law; violations of the live-stock quarantine acts resulted in fines aggregating \$10,275; violations of the meat-inspection law resulted in the assessment of fines aggregating \$3,315; convictions in 73 cases for violations of the game laws resulted in fines amounting to \$3,557; and fines for violations of the insecticide and fungicide act amounted to \$1,100.

An efficiency system has been established in the department affecting all employees, under which advancement will depend wholly upon merit.

A budget or project system for handling all work of the department has been inaugurated, which will make possible the determination of the relative cost of different kinds of work and eliminate duplication.

The work of the extermination of the tick, which is the cause of Texas fever in cattle, has been pushed vigorously in the South, the territory now released aggregating 196,395 square miles. The most effective means of destroying ticks is by dipping cattle in an arsenical solution.

In anticipation of the increased entry of foreign meat, two department specialists were dispatched—one to Australia and one to Argentina—to ascertain whether these Governments maintained adequate supervision of their meat industries. At the present time the only countries in South America in a position to ship meats to the United States are Argentina and Uruguay. Both of these countries are conducting federal inspection by veterinarians of all animals slaughtered for export, and the inspection was found quite competent. A report has not yet been received on Australia.

The production of crops in the United States in 1913 was materially below the average, the yield per acre of all crops combined being smaller than in any year of the last decade except 1911. The corn crop was a little below 2,500,000,000 bushels, the average yield being 23 bushels per acre; the wheat crop, estimated at 753,000,000 bushels, is the largest yield recorded for this country. The oat crop was 1,122,000,000 bushels; the hay crop, 63,460,000 tons; and the cotton crop probably 13,000,000 bales.

RECOMMENDATIONS.

That authority be given to codify existing legislation affecting the department in order to more clearly define its duties and functions, and to prepare and submit to the next Congress a plan for reorganization with a view to broadening the work, unifying its efforts, promoting harmony and economy, and adjusting its relations with the States.

That legislation be enacted for effectively conveying existing agricultural information to the farmer. The methods recommended are embodied in a bill submitted simultaneously in the two Houses of Congress by Hon. Hoke Smith and Hon. A. F. Lever.

That the food and drugs act be amended to permit the establishment of legal standards for judging foods and for a broader definition of a "drug."

That if Federal aid is to be further extended in the construction and maintenance of highways, any legislation to that end should incorporate the principle of cooperation with the States on the condition that the States provide an appropriation at least double that provided by the Federal Government; that no Federal funds should be expended until a scheme of road construction and maintenance within a State had been developed and agreed upon; and that any money appropriated by the Federal Government should be apportioned on the basis of a number of factors.

That the name of the Bureau of Statistics be changed to the Bureau of Agricultural Forecasts, as indicating more clearly the nature of its work.

That the present broad authority for investigating the marketing and distribution of farm products be continued without change and that additional funds be provided.

That provision be made for the establishment of grading standards for various farm products and for the promulgation of the standards already established by the department for cotton and corn grades.

That special consideration be given to the problem of devising better rural credit facilities.

That the law be changed to permit the granting of term licenses on the national forests for the construction of hotels and summer cottages, and for similar purposes, with the view of promoting the recreational use of the forests.

That authority be given the department to cooperate with cities and towns in the safeguarding of the public health through sanitary regulations of the use of national forest watersheds.

That authority be given for the classification and addition to the national forests of public lands valuable only for forest purposes which are now exposed to fire and trespass and which often endanger the forests under protection.

That the law governing the development of water power within the national forests be modified to permit development under terms which will not only encourage the investment of capital but will fully insure the interests of the public.

That means and authority be granted to make more complete studies of domestic conditions on the farm, including the question of practical sanitation and hygienic protection for the farm home as well as labor-saving devices.

That certain modifications be made in the laws relating to the publications of the department to permit the more efficient utilization of its printing fund.

That increases aggregating \$1,074,387 be made in the appropriations of the department for the next fiscal year.

That the salary limit of scientific workers in the department be raised.

Respectfully submitted.

D. F. HOUSTON,
Secretary of Agriculture.

WASHINGTON, D. C., *December 1, 1913.*

REPORTS OF CHIEFS.

REPORT OF THE CHIEF OF THE WEATHER BUREAU.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
OFFICE OF THE CHIEF,
Washington, D. C., August 29, 1913.

SIR: In submitting this annual report of the operations of the Weather Bureau during the fiscal year ended June 30, 1913, it seems proper to state that the undersigned entered upon his duties as Chief of the Weather Bureau August 4, 1913. Consequently such of the report as relates to work done during the past fiscal year deals with affairs accomplished under the administration of his predecessor.

Very respectfully,

C. F. MARVIN,
Chief of Bureau.

The SECRETARY OF AGRICULTURE.

STATIONS AND OBSERVATIONS.

The station and observational work of the Weather Bureau has arrived at the present stage through a slow process of development. In the beginning stations were established primarily for the purpose of furnishing data for use in weather forecasting, being supplemented, nevertheless, by the numerous cooperative stations, the nucleus of which was taken over from the Smithsonian Institution. In later years the value of weather observations has greatly increased because of the increasing application of scientific methods to agriculture and to many lines of commercial activity. An insistent demand for stations has therefore sprung up from all large centers of trade and commerce—a demand that has been met by the maintenance of a large number of so-called corn and wheat, sugar and rice, and cotton region stations, and the like.

It is scarcely possible to estimate the great value of this service in the interests of agriculture and commerce, and in reality we are but just beginning to realize its possibilities.

ORCHARD INVESTIGATIONS.

This line of work was inaugurated in 1912, and more completely organized during the past year by the establishment of numerous stations in certain orchards in western North Carolina, Colorado, Utah, southern California, and Oregon, with the object of correlating certain climatic phenomena and topographic conditions in their bearing on the occurrence and distribution of frosts in the orchards under investigation. Valuable reports are now coming in from these projects for discussion by Prof. H. J. Cox, at Chicago.

WATER RESOURCES BY SNOW SURVEYS.

A new line of work was inaugurated two years ago, and continued last year, by A. H. Thiessen, in charge at Salt Lake City, who advocated systematic measurements of the blanket of snow remaining on the ground at the close of winter over the entire watershed of streams that contribute to important irrigation projects. Such snow blankets constitute the chief storehouse of water supply for the irrigation service in question. Mr. Thiessen has shown that, in certain cases at least, definite measurements of the actual available water supply can be made early in the spring of each year, with the result that the irrigation service can be conducted throughout the following summer upon a basis of comparative facts rather than averages or estimates. The great value of water-resource measurements of this character is obvious, and the service is being extended.

OBSERVATORY BUILDINGS.

The Weather Bureau observatory building at Key West, Fla., which replaced the one that was so badly damaged by the hurricane of October 11, 1910, as to make a new structure necessary, was completed and occupied on January 23, 1913.

The construction of two new observatory buildings was authorized by Congress at its last session. These buildings will be located at Cincinnati, Ohio, and Sandy Hook, N. J. It is expected that they will be completed and occupied before July 1, 1914.

TELEGRAPH SERVICE.

The importance of the telegraph service is coequal with that of stations and observations, at least with respect to the forecast work and the immediate dissemination of important information.

One of the few telegraph lines owned and operated by the Weather Bureau runs along the south Atlantic coast from Cape Henry to Hatteras. Four hundred and seventy-five old and worn-out poles were replaced at points along this line during the past year, and a new submarine cable $1\frac{3}{4}$ miles long was purchased and will be laid in August of the present year across Oregon Inlet, N. C., to replace the old defective cable deeply buried in sand at that point. Further minor repairs will be effected on this line and better provisions made for the maintenance and repair of the line. Some slight improvements will also be effected on the Port Crescent-Tatoosh Island line. In fact, a small building is needed on this line at Neah Bay, Wash.

FORECASTS AND WARNINGS.

The nature of this service is such that but a small part of it can be regarded as essentially new work. The issue of the weekly forecasts, as well as of the daily forecasts, was continued during the year. The weekly forecast is prepared each Sunday morning and immediately distributed through the channels of the press associations and by mail. It is revised Monday and published in the National Weekly Weather Bulletin, issued each Tuesday during the crop-growing season.

A number of special stations have been established in the tobacco fields of Wisconsin, and frost warnings will hereafter be issued for the benefit of this industry.

Through cooperation with the naval radio service of the Navy Department, arrangements have been completed for a daily broadcast distribution of wind forecasts and warnings from two points—Radio, Va., and Key West, Fla.—beginning July 15, 1913. By this means it is hoped to place valuable information in the hands of each shipmaster approaching or navigating the coastal waters of the eastern United States and the West Indies.

The further study of meteorological data with the view of increasing the percentage of accuracy of the daily and weekly forecasts and, if possible, of extending the forecast period beyond one week will be continued as in the past, but particular attention will now be paid to the synoptic charts of the whole northern hemisphere that have become available for such studies only in the past few years.

The study of fog forecasting on the Great Lakes and the ocean coasts was conducted a number of years ago by one of the forecasters, and the results obtained justify a resumption of the study in so far as time permits.

RIVER AND FLOOD SERVICE.

No essentially new work was conducted during the year, although the flood conditions in the Ohio Valley during March, 1913, will form the subject of a special bulletin or monograph thereon. The flood waters later passed down the Ohio and into the lower Mississippi, causing a great flood in the latter, which, following so closely upon the destructive flood of 1912, has directed public attention anew to the menace of floods in the lower Mississippi. A careful survey of the money loss in the 1913 floods places the total at \$145,000,000.

METEOROLOGICAL RECORDS AND PUBLICATIONS.

The customary routine of checking, verifying, compiling summaries, and other disposition made of the large volume of climatological data annually collected by the bureau was continued during the year. The work is practically up to date, and the processes of binding, filing, and otherwise providing for the preservation of this valuable collection have received most careful attention.

The well-known serial and other regular publications of the bureau have been issued in due course.

The project of publishing marine meteorological charts of the oceans was continued until August, 1913, and near the close of the year the whole question of the issue of such charts was given careful study by a committee of Weather Bureau officials, acting in conferences with the Chief Hydrographer of the Navy Department. A unanimous conclusion was reached that an unnecessary duplication existed, and agreements have been formulated for the discontinuance of the issue of meteorological charts by the Weather Bureau and the apportionment of marine meteorological work along lines mutually satisfactory to all parties interested.

A contribution to the literature of floods in the rivers of the United States, entitled "Run-off and Streamflow, Piedmont Section of the Savannah River Watershed," was prepared.

An important monograph entitled "The Great Flood of 1913" is practically completed and will fully discuss the meteorology, hydrology, and other aspects of this unusual event.

A bulletin on the winds of the United States, in course of preparation last year, has been still further delayed pending the securing of additional data regarding variations in velocity with changes in elevation, which it is hoped to obtain from comparative observations of wind movement now being made.

LIBRARY.

About 33,000 volumes of books and pamphlets, including many old and rare works on meteorology, now constitute the meteorological library of the Weather Bureau, and a comprehensive catalogue and index serves to render the information stored in this splendid collection readily accessible to the student and worker generally. Early in January, 1913, the library moved to new and enlarged quarters and was thus enabled to undertake a complete rearrangement and reclassification of the books, which is now in progress.

The librarian has for a number of years acted as supervising examiner in connection with the promotion examinations heretofore conducted by the Weather Bureau in grammar, arithmetic, elementary meteorology, essay writing, algebra, and trigonometry. These examinations were conducted as usual during the past year, 302 employees taking the examinations, and of this number 288 passed, or 76 per cent.

TECHNICAL STUDIES AND RESEARCH.

Legitimate investigations and research are the processes by which the Weather Bureau as an institution grows and attains to greater things, better service, and a mastery over the conditions and phenomena of nature that may render them subservient and beneficent to mankind. The activity of the bureau in this field is, therefore, an index of its prospective growth.

The work outlined below, in so far as it relates to the past year, is of established value and justified by the attitude of meteorological services throughout the world.

The observatory at Mount Weather is headquarters for much of the systematic scientific work conducted by the bureau, and the results for the year may be summarized as follows:

AERIAL INVESTIGATIONS.

Prof. W. R. BLAIR in Charge.

THE DIURNAL CONVECTIVE SYSTEM.—One hundred and eighty-three free-air observations to an average height of 3 kilometers were made in 15 complete series lasting for a period of 24 hours or longer. Kites, occasionally supplemented by captive balloons, were used to carry the meteorograph. A series of observations was made in every 24-hour period throughout which kites could be used. The elements observed are air pressure, temperature, and humidity; wind velocity and direction, and the atmospheric electric potential. The purpose of these observations is to effect as complete a study as possible of the

diurnal convective system. This system is interesting in itself and is to a certain extent typical of the larger convective systems. Conclusions upon the diurnal variation of air pressure, wind velocity, and wind direction, as observed in these 15 series and in three similar series made the year before, can not well be stated until the data have been further reduced and studied. The temperature distribution up to about the 1.5-kilometer level shows the same type of diurnal variation as is observed at the earth's surface. In the region near the 1.5-kilometer level a second maximum of temperature appears after midnight, while the 3 p. m. to 4 p. m. maximum practically disappears. Above this region the 2 a. m. to 4 a. m. maximum is the principal one, the minimum for the day being found at 2 p. m. to 3 p. m., or earlier. There is some variation with the season in the times given for the above maxima and minima. Diurnal variation of the moisture content of the air is closely related to the diurnal temperature distribution. Current publication of the data on the diurnal variation of the different meteorological elements and some discussion of these data were begun in the Bulletin of the Mount Weather Observatory, Volume IV, page 344, and continued in succeeding volumes.

INTERNATIONAL COOPERATION.—Free-air observations on days selected by the international commission were made in cooperation with the commission.

THE FIVE-YEAR SUMMARY.—A complete summary of the data obtained in the five years ended June 30, 1912, has been nearly completed.

MOUNTS WILSON AND WHITNEY EXPEDITION.—Plans were begun in February, 1913, for an expedition to southern California in cooperation with the Smithsonian Institution. Measurements of solar radiation and nocturnal terrestrial radiation at different altitudes and measurements of the total moisture content of the atmosphere above Mount Wilson will be made by the Smithsonian Institution, while the Weather Bureau makes aerial soundings with captive and with free balloons. All preparations for this expedition were completed June 28, 1913.

SOLAR RADIATION INVESTIGATIONS.

Prof. H. H. KIMBALL in Charge.

APPARATUS.—To the equipment of the Mount Weather Observatory enumerated in the last annual report has been added a Sharp-Miller photometer, which, with the assistance of the Bureau of Standards, has been adapted to the measurement of daylight intensities. A Pickering polarimeter has been added to the equipment at Madison, Wis., and a Marvin pyrheliometer was installed at Santa Fe, N. Mex., in October, 1912.

THE DIMINISHED ATMOSPHERIC TRANSPARENCY OF 1912-1913.—The most interesting feature of the observational data for the year is the marked decrease in solar radiation intensities and in the polarization of skylight, which was first noted at Mount Weather in the observations of June 10, 1912. The intensity of direct solar radiation with the sun 60° from the zenith averaged only about 85 per cent

of its normal value during the second half of 1912, and but little more than this during the first half of 1913. The polarization of skylight averaged about 66 per cent of its normal value during the second half of 1912 and about 75 per cent of the normal during the first half of 1913. Similar depressions are apparent in solar radiation and skylight polarization data for the years 1884-1886, 1889-1892, and 1902-1904. Each of these periods followed volcanic eruptions of unusual violence. The low values of solar radiation and skylight polarization the past year are therefore attributed to the scattering of the solar rays by the volcanic dust that was thrown to great heights in the atmosphere by the eruption of Katmai Volcano, in Alaska, in June, 1912.

EFFECT OF DECREASED SOLAR RADIATION INTENSITIES UPON AIR TEMPERATURES.—The three periods of decreased solar radiation intensity, culminating in 1885, 1891, and 1903, were also periods of low temperatures in the United States, and, indeed, in the Northern Hemisphere. While the minus temperature departures were no greater than have occurred in other years, they persisted for a longer time—in the United States for four consecutive years, in the first instance, and for three consecutive years in each of the other two. Since this is a result that might logically be anticipated, Prof. Kimball, in charge of these investigations, made the prediction in a letter to the chief of bureau, dated November 30, 1912, that if the present hazy conditions continue, as is expected, the temperature in the United States will probably fall slightly below the normal in 1913, especially during the first half of the year. This forecast has already been verified, so far as the year has advanced; that is, the temperature in the United States has averaged slightly below the normal during the first half of 1913 and markedly so in February and March. Details of this important matter are discussed by Prof. Kimball in the pages of the Bulletin of the Mount Weather Observatory.

Prof. W. J. Humphreys also has devoted attention to the effects resulting from the ejection of great quantities of volcanic dust particles of minute size into the upper regions of the atmosphere, and has prepared a valuable contribution to the literature on this subject that is now in course of publication simultaneously in the Journal of the Franklin Institute and the Bulletin of the Mount Weather Observatory.

DIFFUSE SKY RADIATION.—Besides the standardization of Marvin pyrhelimeters employed in measurements of direct solar radiation, considerable time has been devoted to the determination of the constants of a Callendar pyrhelimeter, with a view to employing it in measuring the diffuse radiation received from the sky alone, as well as in measurements of the total radiation received from both sun and sky. The standardization has been effected by means of comparisons with a Marvin pyrhelimeter when both were exposed to radiation intensities varying from the total of direct solar radiation to one-tenth that amount.

It has been found that at Mount Weather, on cloudless days, from 15 to 30 per cent of the total radiation received on a horizontal surface at noon is diffuse radiation from the sky. The clearer the sky the smaller is this percentage.

INSTRUMENTS AND THEIR IMPROVEMENT.

Work of this character bears on nearly all lines of investigation and observation undertaken by the bureau and justly deserves every possible encouragement. In several important cases—such, for example, as the measurement of solar radiation, intensity of daylight, evaporation, and even the seemingly simple element of atmospheric moisture—the insufficiency of any known instrumental apparatus appropriate to the work constitutes a distinct barrier to progress. The status of this work is indicated in what follows:

STANDARDIZATION OF ANEMOMETERS.—An investigation of the indications of the anemometer, with special reference to exceptionally high velocities, was undertaken just before July 1, 1912. A large motor-driven whirling machine having a horizontal arm 30 feet long, adapted to carry the anemometer to be tested at the end thereof, and capable of being driven at all velocities up to 75 to 100 miles per hour, measured at the anemometer, was employed for this purpose. The apparatus was installed in the open air at Mount Weather Observatory and tests made from October 9 to November 16, when outdoor weather conditions prevented further work. During the early spring months of the past year the tests were supplemented by comparisons made on the roof of the central office building at Washington of anemometers of different and peculiar construction, for the purpose of showing the effect of modifications on the indications of the instrument. Much valuable technical information has thus far been secured, but the investigation has been temporarily interrupted by the official in charge having become Chief of the Weather Bureau. Provision for the completing of the work will, however, soon be made.

REVISION OF PSYCHROMETRIC TABLES.—Revision of the psychrometric tables in current use is a matter that should receive early attention. Within the past five years there has been an entire revision of the fundamental measures of the saturation pressure of aqueous vapor. This work has been carried out at the Physikalisches Reichsanstalt, at Charlottenburg, and represents, to a certain extent, practically final accuracy in all values of vapor pressures. While the new values at ordinary atmospheric temperatures differ by only small amounts from those heretofore used, yet the latter are not satisfactory, and the present state of applied physical science in this respect calls for a revision of the tabulation of the vapor pressure, and this has been in progress during the year as opportunity to do the work has offered. The revision and extension of the psychrometric formula itself is of still greater importance. At the present time standard psychrometric tables practically terminate at 120° or 13° on the Fahrenheit scale, whereas many demands exist for psychrometric data for temperatures up to and exceeding 200°, as, for instance, in connection with the artificial drying of lumber, the study of cooling towers, and in many manufacturing processes.

NEW RECORDING RAIN GAUGE.—The automatic rain gauge heretofore used by the Weather Bureau is well adapted to the needs of fully equipped stations, but a considerable demand has existed for a type of gauge that could be installed at country places and, to a certain

extent, left to itself for a period of at least several days, and, nevertheless, procure a complete record of precipitation for the interval. A superior gauge meeting these requirements, capable of giving a continuous record of reliable character for a period of eight days without attention, has been devised. A model of the gauge is now nearly completed, and it is confidently expected that the new apparatus will find a valuable use in the extension of automatic records into regions from which results could hardly have been obtained with any of the mechanisms heretofore available.

REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., July 24, 1913.

SIR: I have the honor to transmit herewith a report of the operations of the Bureau of Animal Industry for the fiscal year ended June 30, 1913.

Respectfully,

A. D. MELVIN,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

THE ANIMAL HUSBANDRY DIVISION.

The Animal Husbandry Division, under Mr. George M. Rommel, chief, has continued the various lines of work presented in last year's report and has taken up new work as follows:

ARMY HORSE BREEDING.

For the fiscal year just ended Congress increased the appropriation for experiments in animal feeding and breeding \$50,000, to be expended in experiments in the breeding of horses for military purposes. The plan agreed upon by the Department of Agriculture and the War Department and published as Bureau of Animal Industry Circular 178 was followed, except that farmers are not bound to adhere to the option price of \$150 for 3-year-olds, but may cancel this option at any time by paying the stipulated service fee, which does not exceed \$25.

On account of the fact that the appropriation is not sufficient to permit putting the complete plan into operation, it was deemed necessary to confine operations at present to the territory east of the Mississippi River. Two districts have been organized—the New England horse-breeding district, comprising the States of New Hampshire and Vermont, with headquarters at Middlebury, Vt., and the central horse-breeding district, comprising the States of Virginia, West Virginia, Kentucky, and Tennessee, with headquarters at Front Royal, Va.

Thirty-four stallions were purchased at an average cost to the Government of \$714.45, including salaries and traveling expenses of the purchasing committee. The expense of buying was \$87.58 per head, which is regarded as decidedly reasonable. Six horses were donated to the Government, 5 were assigned to the work from the Morgan Horse Farm, 2 were coming 2-year-olds and are not yet in service, and 1 came through the winter in poor condition and has not yet been used to any extent. The number of remount stallions actually in service at this date is therefore 42. In addition the stallions at the Morgan Horse Farm are available for public service on the Army terms.

The 7 remount stallions in the New England district have covered to date 132 mares, an average of practically 19. In the central district 1,096 mares have been registered, 90 per cent of which will be bred, making an average of slightly over 28 mares for the 35 stallions in this district. The breeding season is always late in Vermont, and it may be expected that considerable numbers of mares will be bred during July, August, and September. In the central district mares are frequently bred in the fall. It is therefore presumable that an average of close to 30 mares per stallion will be obtained for all stallions before the season finally closes, which will be fair for the first season's work.

BOYS' PIG CLUBS.

The division has taken up the organization of boys' pig clubs in an experimental way. The work is being done in cooperation with the Farmers' Cooperative Demonstration Work of the Bureau of Plant Industry and the State agricultural colleges. The State of Louisiana was the pioneer in this work, and the bureau is paying part of the salary of the agent in charge in that State. An agent has also been placed in Alabama to supervise the organization of the boys of that State. There are 1,507 boys in the Louisiana clubs. There are 30 agricultural schools in Louisiana, and pig clubs have been organized at most of them. In Alabama the pig-club work was started late, but 10 counties have been organized and the work is proving popular.

GIRLS' POULTRY CLUBS.

When the girls' canning clubs were first organized by the agents of the Farmers' Cooperative Demonstration Work it was proposed to make them poultry clubs as well. In fact, the official name is "Girls' Canning and Poultry Clubs." For various reasons the poultry side of their work was neglected, largely on account of the lack of poultry experts. The bureau was asked to supply such experts, and a beginning has been made by stationing a poultryman in Virginia, whose duty is to organize the clubs and instruct the demonstration agents in the principles of poultry raising. Twelve clubs have been organized in three counties in that State, and the movement promises to spread with remarkable activity.

THE DAIRY DIVISION.

The bureau's work relating to the dairy industry is carried on by the Dairy Division, of which Mr. B. H. Rawl is chief.

As part of the varied activities of this division public meetings of many kinds are attended by its representatives. During the past

year such meetings numbered 524, and included national, State, and local fairs; international, national, and State conventions; farmers' institutes and short courses in dairy instruction; local meetings of farmers and business men; market milk meetings and contests, and meetings of cow-testing associations. Assistance was given in the organization of 32 live-stock associations.

DAIRY FARMING INVESTIGATIONS.

The principal lines of dairy farming investigations, in charge of Mr. Helmer Rabild, consist of southern dairying, community development in dairying, cow-testing association work, and experimental work.

SOUTHERN DAIRYING.

The work for the development of dairying in the South has been continued in Alabama, Georgia, Maryland, Mississippi, North Carolina, South Carolina, and Virginia. The work in Kentucky was discontinued on March 25 because financial support by the State was withdrawn. Field work was begun in Louisiana on April 15, in cooperation with the State experiment station.

Field men have supervised wholly or in part the building and remodeling of 44 barns and 20 dairy houses. The construction of about 150 silos was also supervised.

About 50 farmers are keeping herd records, and many examples might be cited of improvement brought about by these records and the resultant better feeding of cows. For instance, on one farm a deficit of \$600 in one year was changed to a profit of \$1,100 the next year by proper feeding and the elimination of the poor cows by means of the herd records. A new silo and a new barn were also built.

COMMUNITY DEVELOPMENT IN DAIRYING.

The work for community development in dairying, begun three years ago at Algona, Iowa, was designed to determine the feasibility of raising the economic status of a small dairy community by the employment of a skilled field instructor, who visits the farms, gives advice regarding the management of herds and the product, and lectures at farmers' institutes and other public meetings. The State institutions and likewise the local people took little interest in the work at the beginning of the year, but an excellent spirit of cooperation now exists on the part of both these groups.

The creamery board and the butter makers' association are helping in many ways. Monthly meetings of the creamery patrons are held at different farms. A boys' encampment was held last summer on an up-to-date dairy farm, where the boys learned improved methods at first hand. Many silos have been built, some barns have been remodeled, and a new creamery building is projected, for which the Dairy Division has designed plans. Sixteen creamery patrons are using purebred dairy bulls, six having begun this year. Two patrons have cows under test for advanced registry. The number of cows contributing to the creamery is about 600. Seven dairy farmers are at present keeping records of 115 cows, and the usual results are seen in better feeding and higher profits. A cow-testing association is being formed.

COW-TESTING ASSOCIATIONS.

In the work of organizing and conducting cow-testing associations great progress was made in the Eastern and Middle Western States. In the Rocky Mountain and Pacific States the work has been less successful, owing to the fact that the division has no field man engaged specially upon that line of work in that section. In the eastern and middle two-thirds of the country the Dairy Division has had two field men at work, and the results are seen in the excellent condition of the associations throughout that territory, in which not one has discontinued during the past year.

Sixteen associations were organized and put in operation with the aid of the Dairy Division's field men; 13 others have been organized also with their aid and are now awaiting testers; and 32 have been organized without the direct aid of the division; making a total of 61 new associations, which is an increase of over 100 per cent as compared with those organized in the preceding fiscal year. There are at present 120 active associations, testing over 2,500 herds containing 47,150 cows. Not included in the foregoing are a number of other associations organized by agricultural high schools, the students keeping the records for herds in the neighborhood as part of their school work. Dairy Division men have participated in organizing 9 such associations.

The cow testers are in need of more information in regard to their work, and to supply this demand circular letters are issued from time to time.

Only one bull association was organized, but considerable interest in this work has been shown, and many associations might be formed if there were men who could devote more time to it. Such organizations are needed as a supplement to the cow-testing associations.

OTHER WORK IN DAIRY FARMING.

A method has been devised for giving greater value to herd records and cow-testing association records by enabling dairymen to feed the cows individually according to production. The records have shown that many cows receive too little feed for maximum production, while others receive more than they can utilize. It is often impossible, however, to feed rations varied for each individual, because of the difficulty of remembering. The device now offered is a small slate, costing about 3 cents, to be fastened in front of each cow stall, with that particular cow's ration noted upon it, also her production. This is now included in the equipment of all new cow-testing associations.

A system of feed units for use in cow-testing associations has been prepared and is now being used by several associations. The object is to give a sound basis for comparing the productive ability of cows under different conditions. The units are based on experimental work done in Denmark and Sweden, but adapted to American conditions.

Studies are under way on the merits of concrete stables, round barns, and underground silos. Great interest has been manifested in concrete silos. The Dairy Division has advocated the concrete silo wherever gravel or rock and sand can be had at a reasonable cost. No complaints have been received of the failure of concrete silos. Bills

of material have been calculated for 44 sizes of concrete silo in addition to the 30 sizes of stave silo for which such information had been previously compiled.

An experiment to determine the effect of dipping cattle in arsenical solution on the production of milk and its content of fat and other solids was completed and made the subject of a special report to the chief of the bureau.

As in former years, the chief work of the field men has been accomplished by giving advice, both in personal visits to farms and in public meetings. The results are seen in the increased number of barns built or rebuilt, improvement in stock, keeping of herd records, and formation of cow-testing associations. A noticeable effect the past year has been the large number of silos built.

At the request of the Indian Office, an inspection of the dairies connected with the Indian schools has been undertaken.

WESTERN DAIRY INVESTIGATIONS.

The western dairy investigations were in charge of Mr. A. K. Risser up to April, 1913, when he resigned and was succeeded by Mr. J. E. Dorman. In October, 1912, the headquarters were removed from Colorado Springs, Colo., to Salt Lake City, Utah.

The nature of the work for the development of dairying in the West is similar to that in the East and South, as already reported, but also includes all work of the Dairy Division relating to market milk and dairy manufactures in the Western States.

A special study has been made of market milk in Oregon, Washington, Idaho, Montana, Colorado, and California, and much valuable information has been obtained regarding the cost of producing and marketing milk, prices paid the producer, and methods of milk inspection in the Northwest.

An important part of the year's work has consisted in conducting milk tests and cattle-judging demonstrations at fairs, farmers' institutes, and other public meetings.

Monthly butter-scoring contests have been instituted, which have done much to improve the quality of the butter wherever they have been undertaken. The cost of marketing butter is so great in the Northwest that a plan has been outlined for a cooperative selling association which should prove advantageous both to the creameries and the consumers.

MARKET MILK INVESTIGATIONS.

The work of the section of market-milk investigations, of which Mr. Ernest Kelly is in charge, is largely educational in character and is carried on mainly in cooperation with city health departments with the object of improving local milk conditions.

DAIRY FARM AND MILK-PLANT INSPECTION AND SANITATION.

Twenty cities in 10 States were visited and given assistance in scoring dairies and in making more uniform systems of dairy inspection. This work included scoring 338 dairy farms, 34 city milk plants, and 8 stores which handle bulk milk.

The score card is the most efficient system of inspection in use, combining as it does educational features for the dairyman and rules

for the dairy inspector. The Dairy Division either used or sent out for trial purposes nearly 17,000 copies of the various score cards.

A thorough survey of the milk supply of Johnstown, Pa., was made, in which 295 dairy farms, as well as the city plants handling milk, were scored. About 170 bacterial analyses were made. The scores and bacterial counts showed the milk to be in very bad condition.

In many cities milk is condemned if it has been held at too high a temperature, and such milk is usually poured into the gutter or allowed to go to waste, when it might be used for feeding animals, making casein, or some other purpose. Experiments have shown that rennet is a satisfactory agent for denaturing condemned milk so that it can not be used as market milk, yet need not be wasted.

The work of examining dairies applying for permits to sell milk in various Government department buildings in Washington has been continued.

Circular letters were sent to a large number of cities to ascertain the amounts expended for dairy and milk inspection. The replies received from 208 cities were tabulated to show the expenditures in cents per capita of population. One hundred and sixty-two cities gave fairly accurate replies, and they showed considerable variation, ranging from one-tenth of a cent to a little over 19 cents per capita per year. Twenty-two cities, including several good-sized towns, reported that they did not spend any money at all for milk inspection. Only 43 of those reporting spent 5 cents or more per capita to safeguard the public from the dangers of dirty milk. The average, excluding those that reported no expenditure, was 4.14 cents per capita.

MILK AND CREAM EXHIBITIONS.

Nine milk and cream contests in 7 different States were supervised by representatives of the Dairy Division, and 477 samples of certified and market milk and cream were exhibited and scored. Comments from both producers and health officers continue to prove that these contests are of great educational value to the dairymen and have a marked effect on the general milk supply.

MILK-PLANT MANAGEMENT.

An economic study has been made of about 20 milk plants in cities and large towns, and the labor cost of washing, filling, and capping bottles has been determined. A study was made of the work of a number of milk wagons to ascertain the distance traveled in a day's work and the extent of duplication of routes. Studies were also made of various other factors in the process of serving milk.

PRICES RECEIVED BY FARMERS FOR MILK.

Inquiries were made of dealers in the principal cities to ascertain the prices received by farmers for market milk, and the prices reported were tabulated and reduced to a common basis, namely, the net price per quart at the farmer's shipping station. These prices have been submitted for publication and show a remarkable range. For instance, shippers to the Minneapolis market netted only 2.275

cents a quart for their milk during the month of June, 1912, while shippers to Washington, D. C., during the months of October, November, and December received 5.175 cents per quart. Cities in the Middle West seem to pay the farmer less for milk than any other section, while, with the exception of Washington, the highest prices are paid in the extreme South.

MILK IN THE HOME.

A test was made of the insulated porch box to learn how far it protected the milk from high outside temperatures after delivery. A bottle of milk placed in the porch box was raised in temperature in two hours from 55.4 to 70.7° F., while a bottle outside the box in the same time was raised from 51.8 to 86° F. This experiment gives an accurate measure of the value of such protection.

DAIRY MANUFACTURING INVESTIGATIONS.

The investigations in regard to dairy manufacturing, in charge of Mr. S. C. Thompson, consist of studies of processes and products from a commercial standpoint and in the application of this information. Assistance is rendered to creameries and other dairy manufacturing enterprises by sending this information out in the form of circular letters, bulletins, and correspondence. Creameries are also visited by field men in order to study specific local conditions to make demonstrations of improved methods of management.

CREAMERY MANAGEMENT.

Reports have been received from 1,266 creameries showing in detail the amount of milk and cream received, the percentage of butter fat, the output of butter, prices paid for butter fat, and prices received for butter. The reports received indicate a steady improvement in stopping the leaks and losses incident to operation.

The average "overrun" in the different States has ranged from 18.66 per cent to 21.85 per cent. The average price paid to the farmer for butter fat ranged from 26.72 to 34.53 cents a pound. The cost of manufacturing ranged from 2.04 to 2.95 cents a pound.

Cooperative demonstration work with creameries has been continued by field men in Iowa, California, Texas, Virginia, Maryland, and Pennsylvania according to the plan inaugurated last year, selected creameries in each State being visited frequently and regularly for the purpose of demonstrating the value of improved methods of creamery operation, and also of assisting patrons to improve both the quality and the quantity of their milk and cream. This work has been of great assistance toward increasing the profits of many creameries.

During the year 92 new creameries have been added to our list. Plans of organization, articles of agreement, by-laws, lists of machinery, and plans for creamery buildings have been furnished to inquirers whenever it was apparent that such material could be used to advantage.

A working creamery and cheese factory was exhibited at the International Dairy Show at Milwaukee in October, 1912, and proved an interesting feature.

The cooperative investigations with the creamery at Troy, Pa., were continued throughout the fiscal year, but were discontinued at the end of that period because of change in ownership. The quality of the butter made remained uniformly high throughout the year, and the product was sold at a premium of from 1 to 3 cents a pound over Philadelphia print quotations. During the season of 1912 this creamery packed 216,000 pounds of butter for the Navy. A complete set of manufacturing records was kept, covering all processes involved in the manufacture of butter in such a way that the creamery knew each day the amount of butter fat received and the disposition made of it.

INSPECTION OF BUTTER AND CHEESE FOR THE NAVY.

The Dairy Division inspected butter and cheese purchased or offered for purchase by the Navy Department for use in the Navy. The inspections were made at New York and San Francisco. There was so inspected 154,840 pounds of butter, of which 152,444 pounds was accepted and the remainder rejected; also 3,770 pounds of cheese, of which 2,770 pounds was accepted and 1,000 rejected.

During the year 612,000 pounds of butter was made for the Navy Department under the direction of inspectors of the Dairy Division. Tests were made with samples to determine the keeping quality in cold storage. The original average score of the butter at the time of packing was 94.54 on a scale of 100, and after remaining in storage eight months the butter scored 91.77. On the whole it was a fine lot of storage butter, uniform in quality.

ICE CREAM.

In answer to a circular of inquiry, 101 reports were received from creameries, giving information on methods used in the manufacture of ice cream as a "side line" and the length of time ice-cream making had been practiced. The reports were carefully studied and made the basis of advice.

Investigations have been conducted to determine the relation between the quality and the "swell" of ice cream, and to determine the shrinkage due to transferring from one container to another, the variation in the fat content between the top and the bottom of the container, and the value of condensed milk as a body giver.

RENOVATED-BUTTER INSPECTION.

The inspection of renovated or "process" butter and of the factories where it is produced is carried on under the act of Congress of May 9, 1902. The Dairy Division is assisted in this work by some of the members of the force of the Meat Inspection Division.

During the year 36 factories have been bonded as manufacturers of renovated butter, and 5 have filed closing papers, leaving 31 in operation. The amount of renovated butter produced during the fiscal year was 38,236,321 pounds, a decrease of 8,000,268 pounds from the preceding year.

The factories are inspected at regular intervals of varying length—daily, twice a week, once a week, and three times a month. Three

are inspected irregularly. The inspections numbered 4,079, and 1,434 moisture tests were made.

New regulations regarding sanitation (B. A. I. Order 193) were issued, effective November 15, 1912, and nearly all factories have since made improvements.

MISCELLANEOUS WORK REGARDING BUTTER AND CHEESE.

The inspection of butter on the New York and Chicago markets was concluded November 1, 1912, because after a careful study of its effects it was decided that this work was doing no good. From the beginning of the fiscal year to the time of discontinuance 614 inspections were made.

The butter markets of the South have been made the subject of study during the past three years, and the information collected has been prepared for publication.

Reports were requested and received from cheese factories giving detailed information regarding the manufacture and sale of the product, including financial statements concerning the business.

Some additional results have been secured on methods of preserving samples of milk for analysis. It was found that one part of formalin in 1,700 parts of fresh milk preserved it for from 4 to 6 weeks, but with samples of mixed milk the results were not so good.

EXPERIMENTAL WORK IN DAIRY PRODUCTION.

The experimental work in dairy production, in charge of Mr. T. E. Woodward, is carried on mainly at the bureau's experimental farm at Beltsville, Md., which is shared by the Animal Husbandry and Dairy Divisions.

BELTSVILLE FARM.

During the year the main barn on the Dairy Division's portion of the Beltsville farm has been finished, and the following buildings constructed: Cottage, west wing of barn, stave silo, implement shed. A sewer system has been partially installed, about 1,600 feet of drainage tile has been laid, and the ditch has been dug for laying 1,200 feet more. Sixty-one acres of land has been sown to cowpeas, 67 acres to corn, and 8 acres to crimson clover, rye, and vetch.

The following live stock is now on the farm: One purebred Guernsey bull, 5 purebred Guernsey cows, 11 grade Jersey cows, 13 grade cows of various breeding, and several calves.

EXPERIMENTS WITH CATTLE.

A full year's milk and fat record has been completed with the inbreeding experiments at Beltsville.

Experiments have been begun on testing the open-barn system of stabling cows, and up to the present time the cows have remained in a good state of health, but a serious objection to the open barn is the inability to feed each cow according to her individual needs.

The results in feeding silage so far indicate that there is no difference in the feeding value of silage preserved in a stave silo and that in a concrete silo.

Feeding trials have been made in which sour skim milk was given to Holstein and Guernsey calves, and thus far no detrimental results have been observed, even when the calves were fed on nothing but sour skim milk when two weeks of age.

EXPERIMENTS WITH MILK.

A study of the effect of water or succulence in the ration upon the chemical composition of milk has been continued from last year, and it has been found in experiments both at Brownsville, Tex., and at Beltsville that the percentage of fat can undoubtedly be influenced by the character of the rations despite general opinions to the contrary.

Investigations are in progress to determine the cause of high bacterial counts in milk. Udder infection is the chief factor so far found.

RESEARCH LABORATORIES.

The research laboratories of the Dairy Division, in charge of Mr. L. A. Rogers, deal with chemical and bacteriological problems relating to milk, butter, cheese, etc., and the work for the past fiscal year has been in the main a continuation of previous work. Arrangements have been made to discontinue or bring to Washington the work previously carried on in cooperation with the State agricultural experiment stations at Columbia, Mo., Madison, Wis., and Storrs, Conn. These changes and other work have necessitated additional laboratory space and equipment.

MILK INVESTIGATIONS.

The comparative efficiency of pasteurizing milk in the bottle and pasteurizing it in a vat and bottling it while still hot has been studied, and it has been found that efficient pasteurization may be accomplished by heating the milk in the bottles, but that care should be taken to steam the bottles at least two minutes before filling in order to destroy the heat-resistant bacteria, and to see that the pasteurizing temperature is recorded near the bottom of the bottle. Preliminary laboratory work has demonstrated that in comparison with pasteurization in the bottle equally good and perhaps even more efficient results may be obtained by the usual "holder" process at 145° F. for 30 minutes and filling freshly steamed bottles with the hot milk from the pasteurizer, with subsequent cooling in a blast of air.

An extensive bulletin (Bureau of Animal Industry Bulletin 161) giving the results of studies of the bacteria surviving pasteurization was published during the year.

The work on the effect of ultra-violet rays on the bacteria of milk has been completed, and a preliminary paper published in the Journal of the Washington Academy of Sciences.

A very simple synthetic medium has been found on which alkali-forming bacteria grow readily, and by means of this it has been possible to demonstrate that they utilize as a source of carbon the salts of the aliphatic acids, especially the citrates, malates, and lactates, and that the alkalinity is due to the production of alkaline carbonates, and not to ammonia as commonly supposed.

An extensive study of the gas-forming bacteria, in which for the first time exact measurements of gas were made from a large number of cultures, has shown that the amount of gas and the ratio of hydrogen to carbon dioxid are much more constant than has been supposed and that certain well-marked groups may be established by correlation of the gas volume, gas ratio, and certain fermentation reactions. Sufficient work has also been done to indicate that the increased volume of carbon dioxid and the tendency to variation exhibited by some of the cultures is due to a secondary fermentation.

A striking uniformity in physiological reaction has been found in pure cultures of streptococci from similar sources. This was especially true of the cultures from infected udders and from feces, although the origins of the cultures were in many cases widely separated. The cultures from milk and cream, although they were isolated by methods usually supposed to select the streptococci from infections, did not agree with the cultures either from infected udders or from feces.

BUTTER INVESTIGATIONS.

Numerous changes in the personnel of the force working on butter have retarded those investigations seriously. However, the work is again in good condition, and apparatus has been constructed for detailed study of the changes in the gases of butter.

The study of the effect of boric acid on the bacterial flora and the flavor of butter in storage has shown that no difference can be detected in the bacteria in butter with or without boric acid. This was true both of the butter held at about 40° F. and of that held below freezing.

An investigation now under way has progressed sufficiently to show that butter oil for renovated butter may be blown at a temperature sufficiently high to destroy all pathogenic bacteria without injuring the quality of the product.

The results of the study of factors affecting the flavor of storage butter have been published in a technical bulletin and also in more popular form as a press bulletin.

CHEESE INVESTIGATIONS.

CHEDDAR CHEESE.—In the investigations relating to the Cheddar type of cheese the bacterial flora of a large number of cheeses made from raw milk has been compared with that of similar cheeses made from pasteurized milk. It has been found that the bacteria of the raw-milk cheese are much more varied than those of the pasteurized-milk cheese. The bacteria of the pasteurized-milk cheese consist for the most part of the lactic organisms used for a starter and bacteria of the *Bacillus bulgaricus* group.

Three series of experimental cheeses were made, using various mixtures of cultures isolated from good raw-milk cheese. Nearly all of these developed a bitter flavor. However, the last series made, which were inoculated with varying proportions of a particular culture in combination with a lactic starter, had a flavor more nearly approaching typical Cheddar than any of the ordinary pasteurized-milk cheese.

Chemical studies were made on the cocci and bulgaricus cultures, in which the total volatile acid, lactic acid, alcohols, and esters were determined.

The work done in a cheese factory to demonstrate the value of cheese made from pasteurized milk was complicated by the appearance of Swiss "eyes" in the pasteurized-milk cheese, a trouble which had never appeared at the college creamery. Some work has been done to determine the cause of this phenomenon, and the cheese-factory work will be repeated this season.

A comparatively small amount of cheese of the Cheddar type sealed in cans while fresh from the hoops was made at Troy, Pa. This was of excellent quality after ripening.

SOFT CHEESE.—The soft-cheese investigations have been continued, and results of both scientific and practical importance have been obtained in the determination of factors controlling the growth of molds on cheese of the Camembert and Roquefort types. Considerable work in a Camembert factory in New York has demonstrated that the manufacture of this cheese on a commercial scale is practicable in any factory where proper facilities are provided and methods already outlined in a bulletin of this bureau are followed.

SWISS CHEESE.—Considerable progress has been made in demonstrating the relation of bacteria to the ripening process in cheese of the Swiss or Emmental type. While the differentiation of bacteria found in Emmental cheese still offers great difficulties, we have been able to follow the grosser changes. The morphological group found in fresh cheese is gradually displaced by a second, and a third appears occasionally in small numbers. The propionic-acid bacteria which Freudenreich and Jensen consider essential were not detected in some of the cheeses, but in others they were found in small numbers. Preliminary inoculation experiments have indicated that cultures of the first group mentioned above are necessary for the production of "eyes," but that the essential flavor is not formed unless the propionic-acid bacteria are present. The value of certain strains of the *Bacillus bulgaricus* type in controlling especially harmful gaseous fermentations has been abundantly demonstrated. This knowledge has been applied in a Swiss factory in Wisconsin, under unfavorable conditions, with very satisfactory results.

ICE CREAM, MILK, SUGAR, AND CASEIN.

A preliminary study of ice cream as it is sold to the Washington public has been completed. The average number of bacteria per cubic centimeter was 37,000,000 for samples collected in the summer months and 10,000,000 in the winter samples. A large percentage of these were in many cases of the peptonizing group. Results on many samples from various manufacturers indicate that the high average bacterial content may be greatly reduced by the application of correct methods of sanitation.

A simple and inexpensive method of producing a crude milk sugar has been devised.

Sufficient laboratory work has been done to indicate some of the sources of difficulty in the use of buttermilk casein and to point out possible means of their removal.

MILK SECRETION INVESTIGATIONS.

It has been determined that the color of milk is due to the presence of two pigments, one of which occurs in the serum and one in the fat. As pointed out in the last report, the former is urochrome, the specific urinary pigment. The color of the fat is due to carotin, a substance which gives carrots their characteristic color.

The influence of the plane of nutrition on the composition of milk has been demonstrated in a striking manner. When the ration was changed from hay and grain to cottonseed meal and cottonseed hulls the constants of the fat changed in accord with results published by various experiment stations and ascribed to the effect of the cotton seed. However, a study of the plane of nutrition showed that the animal was suffering from malnutrition, and when the ration was increased to normal with cottonseed meal and cottonseed hulls the composition of the fat returned almost to normal. This slight variation from the normal was found to be the effect of the cotton seed. Previous results on the effect of feeding cottonseed products as a supplement to various roughages have been confirmed. In brief, these experiments show that when cottonseed meal is fed with alfalfa hay and corn silage there is little effect on the composition of the fat, while when it is fed with timothy hay and corn stover there is a pronounced influence upon the chemical and physical constants of the butter fat, this influence being due to the oil in the cottonseed meal.

OTHER EXPERIMENTS.

The experiments in cactus feeding at Brownsville, Tex., have been finished. They show that cactus is a valuable material to feed in connection with cottonseed hulls to make up for the deficiency of the hulls in mineral matter. Eight or 9 pounds of cactus was found to be equal in feeding value to 1 pound of hulls, or 3 to 3½ pounds of cactus is equal to 1 pound of sorghum silage. The vigor of newly born calves seems to be diminished where large quantities of cactus are fed to pregnant cows, but cactus in moderate quantities apparently has no unfavorable effect upon the development of the fetus.

NAVAL ACADEMY DAIRY.

The Dairy Division has continued its cooperation with the pay and supply department of the United States Naval Academy at Annapolis, Md., in the management of the dairy for that institution. The plant has been scored eight times, the scores ranging from 92 to 98. The bacterial counts have ranged from 5,000 to 46,000 per cubic centimeter. Assistance has been given in connection with the economic problems of the dairy, and also in the selection of a farm for the dairy, for which Congress appropriated \$75,000. A high standard has been maintained in the product of this dairy, which is recognized as a valuable adjunct to the academy in the interest of health.

DAIRY ENGINEERING AND ARCHITECTURE.

The investigations in dairy engineering have included studies on refrigeration, the cost of pasteurization, and other problems connected with the economic operation of power plants.

The results of a study of the use of exhaust steam have been published.

A technical paper has been prepared for publication on the cost of pasteurizing in different plants. Another is in preparation on refrigeration as applied to milk plants, creameries, and dairies, in which are discussed the principles involved in refrigeration, both with ice and with mechanical apparatus. A paper on the handling and preservation of milk and cream on the farm will soon be ready for publication.

The work on dairy architecture has included the preparation of stock plans for two types of dairy stables and bills of material for 30 different sizes of stave silos. During the year 803 sets of plans were sent out, making a total of 3,573 blue prints. Plans have been prepared and construction supervised for four new research laboratories for the Dairy Division and for apparatus to be used in research at Washington and Troy.

A septic tank for small buildings has been designed for use at Troy. Special creamery plans were prepared for use at Algona, Iowa. Plans, surveys, and supervisory instructions were furnished for various projects under way at the Beltsville farm. In addition, many charts, sketches, and illustrations have been prepared for the several sections of the division as required.

THE MEAT INSPECTION DIVISION.

The Federal meat inspection is assigned to the Meat Inspection Division, of which Dr. R. P. Steddöm is chief. The work of the year shows a slight decrease from that of the preceding year, doubtless due to the general decline in the number of meat-producing animals in the country.

THE FEDERAL MEAT INSPECTION.

Inspection was conducted during the year at 910 establishments in 251 cities and towns, as compared with 940 establishments in 259 cities and towns during the fiscal year 1912. Inspection was begun at 63 establishments and withdrawn from 115 establishments during the year. The causes of withdrawal were as follows: Discontinuance of slaughtering or of interstate business, 80 establishments; by request, 17; failure to comply with the provisions of the law and regulations, 17; because of exemption under the law, 1.

There is a decrease in the number of all species of animals slaughtered except sheep, which show an increase of over half a million. The decrease in the number of hogs slaughtered is nearly 2,700,000 and in cattle over 375,000. It is noteworthy that with a decrease of nearly 2,700,000 in the total number of animals slaughtered the number of carcasses condemned is nearly 47,000 greater in 1913 than in 1912. The increase in condemnations is greatest in hogs and is due principally to hog cholera. Tuberculosis continues to be the greatest cause of condemnations.

Statistics of the meat inspection for the year are given in the tables which follow.

Ante-mortem inspections of animals, fiscal year 1913.

Kind of animals.	Passed.	Suspected. ¹	Total inspected.
Cattle.....	7,125,467	44,585	7,170,052
Calves.....	2,090,412	3,089	2,093,501
Swine.....	32,277,682	94,593	32,372,275
Sheep.....	14,725,856	5,059	14,730,915
Goats.....	56,562	7	56,569
Total.....	56,275,979	147,333	56,423,312

¹ This term is used to designate animals found or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposition being determined on post-mortem inspection.

Post-mortem inspections, fiscal year 1913.

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle.....	7,099,080	5,961	50,775	7,155,816
Calves.....	2,089,217	51	9,216	2,098,484
Swine.....	31,968,407	145,194	173,937	32,287,538
Sheep.....	14,705,853	1,955	16,657	14,724,465
Goats.....	56,478	2	76	56,556
Total.....	55,919,035	153,163	250,661	56,322,859

Diseases and conditions for which condemnations were made on post-mortem inspection, fiscal year 1913.

Causes of condemnation.	Cattle.		Calves.		Swine.		Sheep.		Goats.	
	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.	Car-casses.	Parts.
Tuberculosis.....	33,001	47,554	450	410	47,630	359,047	1	.....	.....	.....
Actinomycosis.....	380	70,840	3	589	.....	.....	.....	.....	.....	.....
Caseous lymphadenitis.....	.....	.....	.....	.....	.....	.....	2,340	.....	14	.....
Hog cholera.....	.....	.....	.....	.....	88,547	.....	.....	.....	.....	.....
Tumors and abscesses.....	232	3,789	20	185	1,715	3,830	106	55	1	1
Septicemia, pyemia, and uremia.....	1,501	.....	266	.....	10,228	.....	876	.....	7	.....
Pregnancy and recent parturition.....	371	.....	.....	.....	40	.....	104	.....	.....	.....
Immaturity.....	.....	.....	3,848	.....	.....	.....	.....	.....	.....	.....
Pneumonia, pleurisy, enteritis, hepatitis, peritonitis, metritis, etc.....	4,001	.....	920	.....	14,115	.....	3,650	.....	4	.....
Icterus.....	73	.....	26	.....	3,242	.....	1,881	.....	1	.....
Texas fever.....	340	.....	529	.....	.....	.....	.....	.....	.....	.....
Injuries, bruises, etc.....	3,013	824	684	111	1,046	6,911	1,150	185	6	.....
Sexual odor.....	.....	.....	.....	.....	2,315	.....	.....	.....	.....	.....
Asphyxiation.....	.....	.....	.....	.....	1,535	.....	42	.....	.....	.....
Emaciation.....	6,575	.....	2,301	.....	1,256	.....	5,586	.....	40	.....
Cysticercus.....	697	4,348	45	37	72	.....	555	453	1	.....
Miscellaneous.....	591	2,784	124	45	2,196	4,205	366	246	2	.....
Total.....	50,775	130,139	9,216	1,377	173,937	373,993	16,657	939	76	1

In addition to the foregoing, there were tanked the carcasses of animals found dead or in a dying condition, as follows: Cattle, 1,325; calves, 1,197; swine, 45,266; sheep, 5,990; goats, 16; total, 53,794.

The following table, showing meat and meat food products prepared and processed under the supervision of bureau employees, is

a statement of work done rather than a report of the actual quantity of product prepared. The same product is sometimes duplicated by being reported in the various stages of preparation under more than one heading.

Meat and meat food products prepared and processed under bureau supervision, fiscal year 1913, in pounds.

Kind of product.	Weight.	Kind of product.	Weight.
Beef placed in cure.....	153,758,668	Lard stearin.....	4,657,484
Pork placed in cure.....	2,545,357,914	Lard compound.....	6,191,785
All other classes placed in cure.....	3,360,295	Lard substitute.....	662,783,844
Sausage chopped.....	531,626,284	Bakers' compound.....	1,826,254
Canned beef.....	87,364,417	Oleo stock and edible tallow.....	49,618,387
Canned pork.....	23,469,386	Oleo oil.....	141,842,652
All other canned meats.....	4,403,486	Oleo stearin.....	73,243,775
Meat extract.....	311,168	Oleomargarin.....	145,356,382
Steam and kettle rendered lard.....	1,114,334,643	Miscellaneous products.....	1,430,592,450
Leaf lard.....	19,851,102		
Neutral lard.....	88,670,975	Total weight.....	7,094,809,809
Lard oil.....	6,188,458		

The quantity of meat and meat food products condemned on reinspection because of having become sour, tainted, putrid, unclean, rancid, or otherwise unwholesome was as follows: Beef, 6,712,049 pounds; pork, 11,936,913 pounds; mutton, 146,061 pounds; veal, 56,429 pounds; goat meat, 478 pounds; total, 18,851,930 pounds.

For the export of meat and meat food products, 90,653 certificates of inspection were issued, covering 133,582,083 pounds of beef, 840,745,518 pounds of pork, and 2,855,335 pounds of mutton, a total of 977,182,936 pounds. This included 219,750,834 pounds specially prepared with preservatives as allowed by foreign Governments.

There were also issued 2,049 certificates for exports of 17,412,924 pounds of inedible animal products.

EXEMPTION FROM INSPECTION.

The provisions of the meat-inspection law requiring inspection do not apply to animals slaughtered by farmers on the farm nor to retail butchers and dealers. The department requires that such butchers and dealers, in order to ship meat and meat food products in interstate commerce, shall first obtain certificates of exemption, but no such requirement is made of farmers. The number of certificates of exemption outstanding at the close of the fiscal year was 2,548, an increase of 214 over the preceding year. During the year it was found necessary to call in and cancel for various causes 249 certificates of exemption. In many of these cases, however, the certificates were reissued later, when business was resumed or when insanitary conditions had been corrected.

During the past fiscal year 124,384 shipments were made by retail butchers and dealers holding certificates of exemption, as against 124,859 shipments in 1912. The products so shipped were as follows:

Shipments made under certificates of exemption from inspection during the fiscal year 1913.

Kind of products.	Number.	Pounds.
Beef, carcasses (2,039 quarters).....	509	216, 070
Calves, carcasses.....	46, 092	3, 962, 939
Sheep, carcasses.....	4, 731	220, 874
Swine, carcasses.....	1, 595	153, 569
Beef, fresh.....		8, 638, 691
Veal, fresh.....		596, 994
Mutton, fresh.....		1, 723, 164
Pork, fresh.....		660, 037
Cured meats.....		1, 596, 027
Lard.....		104, 762
Sausage.....		162, 863
Miscellaneous (scrapple, tripe, headcheese, beef fat, etc.).....		172, 818
Total.....	52, 927	18, 208, 808

INSPECTIONS FOR THE NAVY.

Upon request of the Navy Department, inspections of meats and meat food products were made for the Navy during the year to determine whether they conformed to the Navy specifications. The meats and products inspected aggregated 12,120,678 pounds, of which 332,304 pounds were rejected. Rejections were made on account of the sour, slimy, or putrid condition of the product, for failure to comply with the specifications regarding the weight or the amount of fat, and because of the substitution of buck, bull, heifer, or cow meat for the meat of wethers and steers. There were also inspected for the Navy 53,850 dozen eggs, 16,290 dozen of which were rejected.

THE FIELD INSPECTION DIVISION.

The Field Inspection Division, of which Dr. R. A. Ramsay is chief, conducts administrative work for the suppression and eradication of contagious diseases of live stock.

ERADICATION OF SOUTHERN CATTLE TICKS.

As the result of the work done in cooperation with authorities of various Southern States for the extermination of the ticks which spread the infection of Texas fever of cattle, areas aggregating 24,556 square miles, as shown by the following table, were released from quarantine during the fiscal year. The total area released since the beginning of this work in 1906 amounts to 187,204 square miles, being a territory greater than the combined areas of Mississippi, Alabama, Georgia, and South Carolina. The work is also far advanced in a large additional territory.

Areas released from Texas-fever quarantine as a result of eradicating cattle ticks, fiscal year 1913.

State.	Square miles.	State.	Square miles.
Alabama.....	811	Oklahoma.....	3, 418
Arkansas.....	2, 818	South Carolina.....	1, 615
California.....	1, 834	Tennessee.....	1, 061
Georgia.....	1, 535	Texas.....	3, 739
Mississippi.....	6, 647		
Missouri.....	185	Total.....	24, 556
North Carolina.....	893		

In addition to the States named in the table, operations are being carried on in Louisiana, Florida, and Virginia.

The total number of inspections was 6,277,295, as against 4,324,540 in the preceding year.

In addition to the large number of inspections made and dippings supervised, a great deal of educational and demonstration work was conducted by bureau employees to teach cattle owners the desirability and importance of eradicating the cattle ticks and to show them the best methods to pursue. This work is done in cooperation with State and local authorities and is being pushed forward as rapidly as possible with the means at hand.

TEXAS FEVER.

The number of cattle shipped from the quarantined area to northern markets was 1,320,579, as compared with 998,338 during the fiscal year 1912, being an increase of 32.27 per cent. These cattle were transported in 42,965 cars, 40,668 of which were cleaned and disinfected under bureau supervision. Reshipments of 399,954 cattle were made from quarantine pens, these reshipments being carried in 12,687 cars. The number of inspections of cattle of the quarantined area was 304,181. The number of dippings was 257,776, being an increase of 58.75 per cent over the dippings of 1912. Of this number 108,608 were second dippings. During the fiscal year 1,385 certificates were issued for the shipment to northern markets of free cattle and those dipped or otherwise treated, as provided in the regulations.

SCABIES IN SHEEP, CATTLE, AND HORSES.

The area quarantined for scabies in sheep has been reduced by releasing from quarantine 18 counties in California, having an area of 70,496 square miles; 9 counties and parts of counties in Nevada, having an area of 31,260 square miles; and 83 counties and parts of counties in Kentucky, having an area of 30,823 square miles, making a total of 132,579 square miles. The State of Kentucky is now entirely freed from quarantine on account of this disease.

The number of inspections made by bureau employees was 59,370,477, the number of dippings supervised was 12,557,457, and 1,298 cars were cleaned and disinfected under official supervision.

The following areas were released from quarantine on account of scabies in cattle: South Dakota, 27,601 square miles; Nebraska, 11,390 square miles; Kansas, 9,000 square miles; Texas, 8,319 square miles, making a total of 56,310 square miles for the year.

The number of inspections was 17,462,824, the number of dippings 1,134,476, and 2,351 cars were cleaned and disinfected under official supervision.

The number of horses and mules inspected for scabies during the fiscal year was 4,052. No dippings were made during the year.

GLANDERS IN HORSES.

During the year 26,663 inspections of horses and mules at Indian schools and agencies were made, and 200 animals were rejected. Of the latter number 153 were rejected for physical defects, and 47 were

quarantined and destroyed on account of being infected with or exposed to glanders. This work was done in cooperation with the Office of Indian Affairs of the Department of the Interior.

LIP-AND-LEG ULCERATION OF SHEEP.

The entire area quarantined for lip-and-leg ulceration (necrobacillosis) in sheep was released from quarantine on August 19, 1911. Since that time inspections for this disease have been made only at market centers, in connection with inspection for other infectious and contagious diseases of animals. During the past fiscal year 19,669 sheep were found to be infected and 28,404 to have been exposed to this disease, and these were disposed of in accordance with the regulations.

INSPECTION OF ANIMALS FOR INTERSTATE MOVEMENT.

There were inspected by bureau veterinarians, in compliance with the laws of the State or Territory to which the animals were destined and upon the request of transportation companies or cattle owners, 178,059 cattle moving interstate for purposes other than immediate slaughter, of which number 19,532 were tested with tuberculin. Of the number tested 629 were found to be diseased with tuberculosis and 50 showed temperatures which required them to be held as suspects for further examination.

There were likewise inspected 46,825 horses and mules, of which 8,208 were tested with mallein, 136 of which showed typical reactions to the test.

VIOLATIONS OF LIVE-STOCK TRANSPORTATION AND QUARANTINE LAWS.

During the fiscal year 1,087 reports of alleged violations of the 28-hour law were submitted by employees of the bureau and placed before the Solicitor of the department. Forty-four cases were filed without further action, on account of insufficient evidence, and 1,001 were presented to the Department of Justice for prosecution. During the year 1,497 cases were tried, including some submitted prior to this fiscal year; 1,444 were decided in favor of the Government and 56 in favor of the defendants; the fines imposed, including costs, amounting to \$57,719.24. Many of these cases required special investigations, which necessitated considerable travel and expense in interviewing witnesses and examining railroad and other records for the collection of evidence by employees of the bureau, who cooperated with the United States attorneys in charge of the prosecutions. Six bureau employees are regularly assigned to this work. However, the greater part of the work of collecting evidence and preparing and submitting reports is done by bureau employees at stockyard centers in connection with their other duties.

There were also submitted to the Solicitor 105 reports of alleged violations of the quarantine laws and the regulations based thereon, as follows: Texas fever, 47; sheep scabies, 32; cattle scabies, 9; glanders, 3; tuberculosis, 12; hog cholera, 2. The reports in 30 cases were filed without further action, on account of insufficient evidence; 48 were referred to the Department of Justice for prosecution; 118

cases were tried, including some submitted prior to this fiscal year; 103 were decided in favor of the Government and 15 in favor of the defendants; the fines imposed, including costs, amounted to \$12,118.04.

THE QUARANTINE DIVISION.

Dr. R. W. Hickman is chief of this division.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS, ETC.

Owing to the existence in the Philippines, Asia, and Africa of communicable diseases dangerous to the live stock of the United States, prohibition against the entry of live stock from such countries has been continued. Also on account of the prevalence of foot-and-mouth disease in most countries of continental Europe permits have not been issued for the importation of ruminants and swine from the Continent. During the first six months of the fiscal year there were repeated outbreaks of foot-and-mouth disease in Great Britain, making necessary the closing of our ports for several months to the importation of ruminants and swine from the United Kingdom. In January, 1913, however, issuance of permits for the importation of cattle from the Channel Islands was resumed, and in March from Great Britain, there having been no outbreak on the Channel Islands, and England having been successful in stamping out the disease more than three months previously.

Owing to the great demand in this country for stock cattle and to disturbed conditions in northern Mexico, inspection work along that portion of the international boundary line has been greatly increased during the year, the number of animals imported being nearly double that of the previous year. The State of Chihuahua and large areas in the State of Sonora are believed to be free from ticks, and cattle from such sections are eligible to entry into the United States subject to inspection and other specific requirements. Certain portions of Sonora, however, are infested with ticks, and as the importation of tick-infested cattle or those which have been exposed to ticks within 60 days before their importation is prohibited by law, and on account of the more or less indiscriminate movement of cattle in Mexico, increased vigilance has been required on the part of bureau inspectors to prevent the possible introduction of infested cattle into the tick-free area of the United States.

The following tables indicate the number of animals imported during the fiscal year:

Number of imported animals inspected and quarantined, fiscal year 1913.

Port of entry.	Cattle.	Sheep.	Swine.	Goats.	Other animals.
New York.....	960	1	.....	.....	270
Boston.....	112	67	.....	.....	.....
Baltimore.....	54	20	1	.....	1
Canadian border ports.....	210	51	12	2	.....
Total.....	1,336	139	13	2	271

Number of imported animals inspected but not quarantined, fiscal year 1913.

Port of entry.	Cattle.	Sheep.	Swine.	Horses.	Mules.	Goats.	Other animals.
New York.....				3,477	2		7
Boston.....				45			3
Philadelphia.....				2			50
Baltimore.....				68			7
San Francisco.....							58
Portland, Me.....				12			
New Orleans.....					1		
Mexican border ports.....	397,359	12,404	3,532	3,495	2,030	23,254	233
Canadian border ports.....	27,863	10,208	95	5,798	94	20	175
Total.....	425,222	22,612	3,627	12,897	2,127	23,274	533

TUBERCULIN TESTING OF CATTLE IN GREAT BRITAIN.

The regulations require that all cattle over 6 months old imported from Great Britain, Ireland, and the Channel Islands shall be tested with tuberculin by an inspector of the Bureau of Animal Industry before being exported or after arrival in quarantine.

The following table shows the results of tests made by inspectors of the Bureau of Animal Industry in Great Britain during the fiscal year:

Results of tuberculin tests in the United Kingdom of cattle for importation into the United States, fiscal year 1913.

Breed.	Passed.	Failed.	Breed.	Passed.	Failed.
Aberdeen Angus.....	3		Jersey.....	413	7
Alderney.....	35		Shorthorn.....	22	16
Ayrshire.....	157	32	Galloway ¹	13	2
Guernsey.....	434	6			
Hereford.....	34	1	Total.....	1,111	64

¹ Imported via Quebec, Canada.

Four Shorthorns included in the above list were retested on arrival in this country and passed the test; and in addition to the above, 1 Aberdeen Angus, 8 Jerseys, and 53 Guernseys, which had not been tuberculin tested prior to shipment, were tested in quarantine, 29 passing the test and 2 reacting.

AMENDED REGULATIONS GOVERNING THE IMPORTATION OF HORSES.

In view of the fact that dourine has been introduced into this country through the importation of horses entered for breeding purposes, it has been considered advisable to place greater restrictions upon the entry of horse stock. Accordingly regulations governing the importation of horses have been so amended as to require, in the case of horses from any part of the world except North America, certain certificates and affidavits pertaining to the freedom from disease and from exposure thereto. It has also been provided that such horses may be quarantined at the port of entry at the expense of the owner and subjected to blood or other tests as may be required to determine whether or not they are free from disease.

IMPORTATION OF HIDES, FEEDSTUFFS, ETC.

In conjunction with the Department of State and the Treasury Department, the close supervision of imports of hides, horns, bones, glue stock, horsehair, plucked and picked wool, feedstuffs, straw, etc., has been continued, with the object of preventing the introduction of the infection of anthrax or other diseases with such products. Among the requirements, which vary according to circumstances, are disinfection, certificates of origin, etc.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

The work in connection with the inspection of vessels and export animals has fallen off very materially. Only a few small shipments have been made since August, 1912.

There have been several shipments of purebred animals for breeding purposes to foreign countries, such as cattle to Japan, cattle and swine to South Africa, swine to Spain, and cattle, swine, and sheep to various South and Central American ports.

During the year 160 inspections of vessels carrying live stock were made before clearance and 276 certificates of inspection were issued for American cattle, sheep, swine, and horses. Certificates are not required for the shipment of cattle, sheep, swine, and goats to the West Indies, Central America, and South America, excepting Argentina and Uruguay.

The following table gives statistics of inspections of live stock for export:

Inspections of American and Canadian animals for export, fiscal year 1913.

Kind of animals.	American.				Canadian.		
	Inspections.	Rejected.	Tagged.	Exported.	Inspections.	Rejected.	Exported.
Cattle.....	4,260	3	3,783	2,441	9,706		9,706
Sheep.....	7,416			2,054			
Swine.....	31			31			
Horses.....	805			805			
Mules.....	998			998			
Asses.....	4			4			
Goats.....	6			6			
Elk.....	2			2			
Monkeys.....	4			4			
Cats.....	1			1			
Dogs.....	11			11			
Total.....	13,538	3	3,783	6,357	9,706		9,706

During the fiscal year 15,245 horses and 538 mules were tested with mallein for shipment to Canada. Of this number 193 horses were rejected on account of reacting to the test.

For Canadian shipment there were also tested with tuberculin 569 cattle, of which 5 reacted, and inspections were made of 54,825 sheep, 234 swine, and 1 goat.

For shipment to the Hawaiian Islands there were tested with tuberculin 86 cattle, of which 4 reacted; and the mallein test was applied to 399 horses and 1,064 mules, of which 12 horses reacted; and inspections were made of 37 swine.

SUPPRESSION OF BOVINE TUBERCULOSIS.

Cattle owners in Virginia, Maryland, and the District of Columbia have evinced greater interest in the tuberculin testing of their herds and an increased desire to have the testing done officially under the supervision of the bureau rather than privately.

Activity upon the part of the dairy and food division of the State of Virginia and the health department of the District of Columbia has been helpful from an educational standpoint and otherwise in influencing numerous herd owners to request the bureau's cooperation in this work.

It is gratifying to note that from the beginning of the year there has been observed the lowest percentage of reactors among cattle not previously tested of any year since this cooperative work was taken up, five years ago. This indicates that many of the centers of tuberculosis in the territory covered have been found and the conditions greatly improved, and this view is sustained by the further fact that during the year 78 herds in Virginia and Maryland to which the first test was applied were found to be entirely free from tuberculosis infection, and in the annual retesting of herds in these States the percentage of reactors was found to have been reduced to 3.26. The records also show that 69 formerly tuberculous herds are now being maintained free from tuberculosis. In the case of 56 herds and premises where retests were applied last year no case of tuberculosis has been found during the five years of cooperative work. The tuberculin tests applied in Virginia, Maryland, and the District of Columbia to new herds and retests of old herds include 11,050 dairy cattle, with an average percentage of tuberculosis of 4.93. At present cooperation is being given by the bureau to 203 herd owners in Virginia and Maryland, whose cattle are being maintained free from tuberculosis. Only 1.83 per cent of tuberculosis was found among cattle in the District Columbia.

During the fiscal year 747 cattle, entering the District for slaughter, were tagged by a bureau employee, in accordance with an order of the District Commissioners. This number is exclusive of steers and calves, also of carload shipments consigned to the abattoir at Benning, D. C., where bureau inspection is maintained.

At the request of the Office of Indian Affairs of the Department of the Interior, the bureau has undertaken an investigation as to the prevalence of tuberculosis and the sanitary conditions in the dairy herds at Indian schools and reservations. Experimental inspection was made by cooperation between the Quarantine and Dairy Divisions of the bureau at eight schools in various sections of the country. Out of 279 cattle tested with tuberculin 56 (or 20 per cent) reacted. The average sanitary score was 33.68 on a scale of 100.

ERADICATION OF DOURINE.

Cooperative work with the State authorities of Iowa for the eradication of dourine has been continued. Supervision has been maintained over exposed horses which were under State quarantine on June 30, 1912, and such animals have been subjected to examination by means of the complement-fixation method, as mentioned under the heading of the Pathological Division. It is now believed that the disease has been eradicated from the State.

Mares and stallions which, previous to the discovery of the disease, had been shipped from infected farms into other States have been traced, inspected, and tested, with results which indicate that the infection has not been disseminated from there.

In July, 1912, the bureau received a report from the State veterinarian of Montana regarding a disease of horses in Custer County which he believed might be dourine. Investigation by the bureau confirmed the suspicion, and active measures were immediately taken in cooperation with the State authorities to determine the extent of the infection, to quarantine infected ranches, to make blood tests of exposed horses, and to slaughter infected horses. As a result of the work thus far done by the bureau inspectors, it has been determined that the disease has become more or less prevalent in the eastern section of Montana and extends into the western portions of North and South Dakota.

THE PATHOLOGICAL DIVISION.

The work of the Pathological Division, of which Dr. John R. Mohler is chief, has consisted, as heretofore, in the scientific investigation of animal diseases. A number of serious outbreaks of infectious diseases in several States called for attention.

FORAGE POISONING.

The statement in the annual report for 1912 that cerebrospinal meningitis or forage poisoning had exacted a heavy toll in the death of horses during the year is also true for the fiscal year 1913, the loss of horses being even greater. The brunt of the trouble fell this year on the Middle West, principally on Kansas and Nebraska, where the mortality was exceedingly high, but the disease was prevalent elsewhere, occurring in Louisiana, Oklahoma, Oregon, Georgia, West Virginia, Maryland, and New Jersey. One county in New Jersey alone lost 400 horses.

In Kansas and Nebraska 20 bureau veterinary inspectors were assigned to the infected territory to make observations on the disease and to advise measures for control and treatment.

The consensus of opinion of those investigating the disease was that the feed or water contained the detrimental elements that were the causative factors, and observation based on the fact that animals recovered after being removed from infected pastures to other conditions of feed and water seemed to bear out these conclusions.

The active agent in the development of this disease has not yet been satisfactorily demonstrated. While the indications of forage poisoning, which are always present, do not supply all the evidence desired regarding the specific cause of the outbreaks, they must still be granted an important place in the consideration of the disease until future investigations furnish something more definite.

DOURINE.

The method of diagnosis of dourine by the complement-fixation test which has been successfully worked out by the Pathological Division has been found very useful, since all indications show that this method is beyond a doubt the only reliable procedure by which chronic and latent cases of dourine can be diagnosed. The technique of the complement-fixation test for this disease as first described has

been somewhat modified and simplified by the present method, which is described in a paper prepared for publication.

The laboratory diagnosis has thus far coincided with the clinical and post-mortem findings in cases where the animals have been destroyed.

During the fiscal year laboratory tests were made of 4,970 cases, of which 634 gave a positive reaction.

GLANDERS IMMUNIZATION.

A series of experiments has been undertaken to determine whether or not vaccination with dead glanders bacilli is effective for immunizing horses against glanders. About 20 horses and a small number of guinea pigs were used in the tests. The horses were previously tested by the various serum and mallein tests and were proven free of glanders. The vaccine consisted of emulsions containing dead bacilli, and the preparations tested included a bacterin obtained from the board of health laboratory of New York, which was being used extensively by practicing veterinarians in New York, while another preparation of a standard emulsion of dead glanders bacilli grown on glycerin-agar was prepared in the pathological laboratory of this bureau.

The definite results are not yet available, but thus far the method appears to be ineffective as a means of immunization, and furthermore the result of the vaccination appears to have a prolonged influence on the serum tests for glanders, so that the blood of vaccinated animals is not available for diagnostic purposes.

GLANDERS INVESTIGATIONS.

The laboratory has continued to employ the complement-fixation and agglutination methods for the diagnosis of glanders. About 1,750 samples of blood serum from suspected and contact cases have been received and tested. The results have been of a uniform character and such as to indicate that when these methods are employed independently of the subcutaneous mallein test they constitute the most reliable means now available for detecting and verifying the presence of this disease. Recent experiments, however, have shown the inadvisability of employing the serum methods of diagnosis in conjunction with the subcutaneous mallein test, unless the serum samples are collected either previous to the administration of the mallein or within 24 hours thereafter. This is owing to the frequent development of immune bodies in the blood serum of normal malleinized animals as a result of the injection of mallein. For the disappearance of these substances a period of 30 days has been found necessary in most instances, and in the event of more than one mallein test having been applied within a period of from 2 to 8 weeks it has been found advisable to permit the lapse of at least 60 days from the date of the last mallein test before collecting samples, in order to eliminate the possibility of interpreting reactions incorrectly.

INFECTIOUS ABORTION OF CATTLE.

The work on abortion has been continued. Besides routine work and the testing of numerous samples of serum forwarded for the purpose of determining the presence of infectious abortion in various

herds by means of the complement-fixation and agglutination tests, experiments have been continued with the view of obtaining an immunizing agent for the protection of cows against infectious abortion. For this purpose living cultures, heated carbolized (0.5 per cent) cultures, and old cultures have been used, both by feeding and by inoculating subcutaneously, intra-abdominally, or intravenously. The rate of immunity production in these animals is being ascertained by the agglutination and bactericidal determination of their sera.

In the field investigations with four herds satisfactory results have thus far been obtained, especially with carbolized unheated cultures.

INFECTIOUS MASTITIS OF CATTLE.

In a herd of Holstein cows owned by a Government institution there appeared a very virulent form of infectious mastitis making rapid progress and attacking many of the animals in spite of frequent veterinary treatment. Various medicinal agents recommended were tried, but with no beneficial results. A vaccine was prepared from streptococci derived from the lesions and grown on artificial media, with the addition of fluid from secretions of affected udders, and this was used with good results, some of the bad cases having apparently recovered and no new cases having been reported.

BIGHEAD OF SHEEP.

Continued investigations of the disease known as bighead of sheep have shown that this is not an infectious disease, as it is not transmissible from affected to healthy animals. It is a condition brought about by severe exertion of sheep during very warm weather, especially after a cold storm or a cold night. It has been found that where the flock is handled properly while on the trail—that is, not driven too far nor too fast during the hot portion of the day, especially if the preceding night has been cold or stormy—none of the sheep will contract bighead. Flockmasters of the affected regions have recently utilized this knowledge so generally that only a very few cases have appeared, and the losses have been slight in comparison with those of a decade ago.

RABIES.

The number of animals received for examination because they were suspected of being affected with rabies indicated that there is no diminution in the number of rabid animals in and around the District of Columbia or in the suffering and distress caused by their attacks.

Microscopic examinations were made of the brains of 207 suspected animals, of which 119 dogs, 6 cats, 6 cattle, and 2 horses, or a total of 132, were found to have been affected with rabies at time of death, while 62 were found to be free from the disease, and 12 were undetermined at the close of the fiscal year. At least 108 persons were bitten by the dogs and cats examined. Rabid animals were received from Texas, Tennessee, Kentucky, West Virginia, Maryland, and the District of Columbia.

GLANDS FROM TUBERCULIN-REACTING CATTLE.

A number of specimens have been received which originated in cattle that had reacted to the tuberculin test but in which no lesions

of tuberculosis could be discovered at the time of post-mortem examination. In fully half of these cases tubercle bacilli have been positively identified when the tissues have been subjected to careful laboratory tests, proving that tuberculosis had really become established in the animals previous to their testing.

BLACKLEG VACCINE.

The requests for blackleg vaccine during the past year have been unprecedented. The calls for this material during the summer months of 1912 were totally unexpected, and some delay in filling orders was unavoidable, since it was impossible to purchase suitable calves for supplying the virus without some notice in advance. The output for the year amounted to 1,913,195 doses.

BIRD DISEASES.

A disease of canary birds was investigated in two outbreaks occurring in the District of Columbia. A motile polar-staining bacillus belonging to the enteritidis group and closely resembling the paratyphoid B bacillus in morphology and in cultural characteristics was isolated in pure culture in each outbreak. The organism is pathogenic to guinea pigs, rabbits, and pigeons, death resulting from septi-cemia in 3 to 7 days. Hens and ducks are insusceptible.

On March 5, 1913, the carcass of a goose was received from Indiana for examination. The owner reported a loss of 50 per cent of his flock. The disease was characterized by the extremely short period of noticeable illness. The only apparent symptoms were drooping of the wings and a tendency to lie down after walking a few steps, death following in 15 to 30 minutes. On autopsy the heart showed a number of hemorrhagic spots near its apex, the left lung showed a small congested area, and the capsule of the liver was thickened and supported a serofibrinous exudate. The *Bacillus avisepticus* was isolated in pure culture from the heart, blood, and liver, and produced death in guinea pigs, rabbits, and ducks in 24 to 48 hours.

THE DIGESTIBILITY OF IMMATURE VEAL.

The examination of immature veal for the purpose of determining its digestibility and food value has been continued. Data have been obtained upon the flesh of 7 calves, all under 7 days of age when killed, and upon 7 samples of matured lean beef which were used as controls. This work is still in progress.

EXAMINATION OF CREAMERY BUTTER FOR PATHOGENIC ORGANISMS.

An opportunity was afforded the Pathological Division, through the cooperation of the Dairy Division, to obtain samples of first-class creamery butter manufactured in a number of different States. One hundred and two samples were tested for the determination of the presence of tubercle bacilli and the bacilli of infectious abortion, by means of guinea-pig inoculations. The final results of this test were highly satisfactory, since none of the samples caused the development of any lesions either of tuberculosis or those characteristic of infectious abortion.

COLLECTING MILK SAMPLES FOR THE CATALASE TEST.

During the fiscal year an experiment was conducted to determine some method by which health officers could apply some antiseptic to milk before shipment so as to make practicable the catalase test for market and individual milk, the main object of the experiment being to find some preservative which would not interfere with the catalase test and yet would prevent the development of bacterial catalase and the decomposition of the milk during shipment. After trying a number of the ordinary preservatives in varying proportions, such as phenol, chloroform, bichlorid of mercury, and boric acid and glycerin, it was found that a combination of 4 per cent of boric acid dissolved in glycerin used at the time of milking in the proportion of 14 c. c. to 100 c. c. of milk gave the desired results, preventing the formation of bacterial catalase for a period of 44 hours, a length of time sufficient for ordinary shipment to the laboratory.

THE BIOCHEMIC DIVISION.

The work of the Biochemic Division is under the direction of Dr. M. Dorset, chief.

LABORATORY MEAT INSPECTION.

As in previous years, the laboratory meat inspection has consisted chiefly in the routine examination of samples of meat and meat food products, and all ingredients used in such products, which are sent to the laboratories by inspectors in charge of meat-inspection stations.

During the past fiscal year a total of 27,264 samples were examined. These were of the most varied character, consisting of prepared meats, fats and oils, cereals, gelatins, coloring matters, spices, disinfectants, insecticides, water, and all substances used in the preparation of meat food products. The results of the laboratory inspection indicated that the illegal use of preservatives and coloring matters is not practiced at establishments under Federal inspection. The results showed, however, that considerable difficulty is experienced by meat inspectors in properly controlling the use of cereals in sausage and prepared meats. This difficulty is for the most part caused by carelessness on the part of packing-house employees. In all cases where cereals are found in articles not properly labeled, as well as in all other cases of violations of the regulations discovered through laboratory examination, a report of the findings is made to the Meat Inspection Division in order that suitable steps may be taken to prevent such occurrences in the future.

Considerable attention has been given in the routine laboratory inspection to the condition of spices used in the preparation of meat food products. This work has resulted in the condemnation of large quantities of spices found in packing houses, which contained dirt or were otherwise contaminated or unfit for use. The question of spices was taken up with the Bureau of Chemistry, and it is believed that much improvement has taken place in spices offered for use in meat food products.

During the year 394 samples of water, taken from 70 different stations, were submitted for examination to determine their suitability

for use in meat and meat food products. The examinations, which included both chemical and bacteriological analysis, resulted in the condemnation of 33 different sources of water supply at 24 meat-inspection stations.

During the year 4,310 gallons of ink to be used in applying marks of inspection to inspected meats was prepared and shipped to the various stations. The total cost of this ink, including labels, materials, and containers, was approximately \$1,500 for the entire year.

RESEARCH WORK ON MEAT PRODUCTS.

Meat extracts are prepared from various parts of the carcass, and in order to determine whether or not particular lots of these extracts are properly labeled it is necessary to identify or detect the presence of extracts from various parts of the carcass. Work on this subject has resulted in the development of a method for differentiating the various meat extracts, and a report on this subject is now in course of preparation.

A very careful study of the water content of sausage has been made. The work so far has consisted for the most part in the study of pure pork sausage. It appears from the results that in pork sausage meat and in pure pork sausages a fairly definite ratio exists between the protein of the meat or sausage and the water present. The addition of water may therefore be detected through the determination of the ratio of protein to water in the finished product. These results have been of much service in enabling the laboratories to assist in the enforcement of the provision of the meat-inspection regulations limiting the addition of water to sausages.

Questions relating to the cold storage of meat have been studied with the object of determining the character and extent of the changes that take place in meat when placed in cold storage, thus enabling the department to determine how long such product may be kept in storage without becoming unwholesome, and also what factors are of most importance in maintaining meats in a wholesome condition while in storage. The work thus far has been mainly a study and perfection of methods to be used in the regular work.

The detection of the presence of vegetable fats in lard substitutes or compounds has occupied attention, and as a result a paper describing a method for the detection of phytosterol in mixtures of animal and vegetable fats was published.

The recent introduction of hydrogenated oils as food products has necessitated considerable study of these products.

A number of other problems of minor importance have been investigated; for example, a bacteriological study of "brush" fats, the use of lacquer on lard pails, the denaturing of greases, and the use of sodium bicarbonate in rendering lard.

DIPS AND DISINFECTANTS.

The examination of dips, disinfectants, and more or less related materials for official use submitted by manufacturers, bureau employees, and other Government officials has been continued.

The work in cooperation with the Insecticide and Fungicide Board has been continued. In collaboration with the Pathological Division extensive studies concerning the toxicity of certain insecticides in-

tended for use on domestic animals have been started and much valuable information is being secured.

The experiences of the past year served to establish the practicability of the field testing outfit devised for testing arsenical dipping baths in connection with the work of tick eradication, and it also showed the indispensability of such a testing outfit for the successful prosecution of that work. As a result of this field testing, dipping baths supposedly of the proper strength were found to be sometimes higher and frequently much lower in arsenic content than had been supposed by the field inspectors. A large number of testing outfits have been prepared and the necessary solutions furnished to field inspectors.

The phenomenon of oxidation in arsenical dipping baths has been given further study. Arrangements were made at the beginning of the present dipping season to have samples forwarded regularly from dipping vats from different sections of the country, some being from small vats where only a few cattle are dipped and others from large vats where thousands are dipped. This work is not yet completed, but it is expected that from the data secured it will be possible to deduce quite definitely and to what extent and under what conditions oxidation may be expected to occur under ordinary field conditions. The effect of oxidized arsenical baths upon ticks and upon cattle is a question which is being investigated by the Zoological Division of the bureau.

In addition to studying the causes of oxidation and of the conditions under which it develops, a study has been made of methods to prevent oxidation. Promising results from a laboratory standpoint have been obtained, but the actual effectiveness and practical economy of preventing this oxidation can only be determined by experiments in the field.

Some additional work on the subject of the absorption and retention of arsenic in the tissues of dipped cattle as well as in the milk has been carried out, but the results secured have not changed the conclusions reported last year, namely, that the amounts absorbed are too small to be of any importance as far as the use of the meat and milk of the dipped animals for food is concerned.

Recognizing certain deficiencies of the "standard arsenical solution" recommended by the bureau, namely, the necessity of boiling considerable quantities of liquid and the impossibility of preparing concentrated stock solutions, the laboratory took up the question of devising a dip which could be easily and cheaply prepared by anyone without the aid of heat and which could be indefinitely preserved in the form of concentrated stock solutions, requiring simply dilution with cold water before using. As a result of this work, a formula has been worked out which seems to meet the requirements and which has been subjected to field trial by bureau inspectors. The formula for this self-boiled arsenical dip differs from that of the "standard arsenical solution" in that a part of the sodium carbonate is replaced by sodium hydroxid. This change permits the employment of much less water, and the heat evolved by the chemical reaction renders the application of external heat unnecessary. Precise directions for preparing the self-boiled arsenical dip are contained in a paper which has been submitted for publication.

In addition to the above work, which is chiefly chemical in nature, a considerable amount of bacteriological work relating to the disinfection of hides has been carried out. This work, while involving the examination of a number of methods of disinfecting hides, has consisted chiefly in a critical study of the so-called Seymour-Jones method. This work is being carried out in cooperation with the Paper and Leather Laboratory of the Bureau of Chemistry.

FEDERAL CONTROL OF VETERINARY BIOLOGICAL PRODUCTS.

The last Congress passed a law requiring that all viruses, serums, toxins, and analogous products intended for use in the treatment of domestic animals must, if shipped interstate or imported into the United States, comply with certain regulations of the Secretary of Agriculture. The sum of \$25,000 was set aside by Congress for the enforcement of this law. Considerable time was spent during the concluding months of the year in preparing for the work required by this law.

PREPARATION AND DISTRIBUTION OF TUBERCULIN AND MALLEIN.

During the past fiscal year 351,067 doses of tuberculin were sent out to State, county, and city officials to be used in testing cattle for tuberculosis, and 150,666 doses of mallein were likewise furnished for testing horses and mules for glanders.

During the year considerable work was done in connection with the preparation of a suitable mallein to be used in the ophthalmic test for glanders, and a very satisfactory preparation was secured. It has been tested with satisfactory results by the Pathological Division.

THE ZOOLOGICAL DIVISION.

The work of this division is in charge of Dr. B. H. Ransom, chief.

TRICHINOSIS.

Experiments have been undertaken to determine the temperature required to kill trichinæ larvæ, for the purpose of establishing a basis for meat-inspection requirements with regard to cooking pork products so as to protect consumers from the danger of contracting trichinosis by eating imperfectly cooked pork. Accurate data on this point have been lacking. In the household it is a good rule to cook pork until it is well done throughout, but such a requirement in the case of meat-packing establishments would be impracticable and unnecessarily stringent. All that is necessary is that sufficient cooking be required to make certain that the temperature in the interior of the meat reaches a point which is fatal to the trichina larva.

The results already obtained in the investigations referred to show that the parasites die after a brief exposure to a temperature between 53° and 55° C. (127.4° to 131° F.). It would seem that these temperatures are so low that even very imperfect cooking would be sufficient to insure the death of any trichinæ which might be in pork. In the process of cooking, however, the temperature of the interior of pieces of meat rises very slowly, and to remove danger it is necessary that a sufficiently high temperature be reached throughout the interior of the meat. A simple method has been devised by which

it is possible to determine readily whether the temperature in a given piece of meat has reached a certain point, and it is believed to be desirable to adopt some such method in the official control of cooking processes in meat-packing establishments as soon as the final results of the present investigations have been obtained.

SHEEP MEASLES.

Sheep measles occasionally reported from other countries has been found to be of common occurrence in sheep in the western United States. The parasite, named *Cysticercus ovis* by Cobbold in 1869, has been generally considered to be identical with *Cysticercus cellulosæ*, the pork measles parasite, although some authors have held that it is *C. tenuicollis*, explaining its differences from the latter as being due to its different location, that is, in the muscles instead of in serous membranes. Recent investigations by this bureau have proved that *C. ovis* is a distinctly different species from both *C. cellulosæ* and *C. tenuicollis*, and that it is the intermediate stage of a dog tapeworm and is not transmissible to man.

The results of these investigations have been prepared for publication.

TAPEWORMS OF SHEEP.

A continuation of the investigations relative to the fringed tapeworm of sheep has failed to reveal the mode of transmission of this parasite from sheep to sheep.

GID IN SHEEP.

That gid is present in Arizona seems probable, in view of the loss of a considerable number of sheep originating in that State which were bought for feeding in Kansas, the symptoms being those of gid. The disease heretofore has been found enzootic only in Montana.

In connection with the enforcement of B. A. I. Order 176, the feces of 138 imported sheep dogs held in quarantine were examined microscopically, and 26 were found to be infested with tapeworms (*Tænia*). These dogs were treated with tæniacides under supervision of the Quarantine Division and were released when the tapeworms had been expelled and when subsequent examinations showed the feces to be free from tapeworm eggs.

INVESTIGATIONS CONCERNING TICKS.

Arsenical dips containing an equivalent of 8 pounds of arsenic trioxid to 500 gallons of water were found in a series of dipping experiments to protect cattle from tick infestation for a period of two days, but they afforded no protection when five days or more had elapsed after dipping.

The protective action of arsenic was determined to be toxic and not repellent; that is, there was no hesitancy on the part of the seed ticks in attaching themselves to the dipped animals; the cattle failed to become infested because the ticks were killed by the arsenic which they absorbed after getting upon their hosts. Further investigations relative to the protective action of arsenical dips are in progress.

It has been observed that engorged female ticks from cattle suffering from acute Texas fever show an unusually high mortality; in some

cases as many as 95 per cent succumb, whereas it is usually the case that very few engorged ticks fail to survive and oviposit when kept under favorable conditions.

Oxidized arsenical dip tested in comparison with unoxidized dip has been found to be practically the same in its toxicity to animals dipped in it. On the other hand, the former had only a very small fraction of the efficacy of the latter, according to tests made on larval ticks. Further investigation on this point is in progress, and definite conclusions have not yet been reached, but there seems to be no doubt that an oxidized dip is considerably less efficacious than an unoxidized dip containing the same amount of arsenic.

INVESTIGATIONS CONCERNING PARASITIC PROTOZOA.

Attempts to cultivate the Texas-fever parasite along the lines followed in the artificial cultivation of malaria organisms have as yet given no results.

MISCELLANEOUS WORK.

A test of the carbon-bisulphid treatment for bots in horses has demonstrated that this remedy is an efficacious means of expelling these parasites.

Comparison of the common roundworm of hogs and the similar parasite found in man has failed as yet to show any differences between them. The continuation of development to the infectious stage has been noted in the case of *Ascaris* eggs kept in formalin solutions and other fluids ordinarily fatal to parasite eggs; thus, in part at least, the statements of various authors as to the great resistance of *Ascaris* eggs have been confirmed.

In cooperation with the Division of Zoology of the Hygienic Laboratory, United States Public Health Service, the manuscript of the part of the Index-Catalogue of Medical and Veterinary Zoology relating to the nematodes has been practically completed.

THE EXPERIMENT STATION.

The general character of the work at the experiment station at Bethesda, Md., under the direction of Dr. E. C. Schroeder, superintendent, consisted of investigations, both independent and in cooperation with other divisions of the bureau, concerning diseases of animals and the provision of facilities to enable the other divisions to do experimental work of a kind that requires farm and field conditions. As the cooperative work has already received attention, this part of the report will be confined to the station's independent investigations. The experiment station deals with diseases of animals and is separate from the experimental farm at Beltsville, Md., where investigations in animal husbandry and dairying are carried on.

TUBERCULOSIS INVESTIGATIONS.

On the subject of tuberculosis a number of studies have been undertaken and remain in progress. One of the more important deals with a method by which healthy herds of cattle may be derived from diseased herds. It seems from the observations and tests made at the station during a number of years that it is easily possible to derive a healthy from a tuberculous herd of cattle.

Experiments are still in progress concerning the transmission of tuberculosis from animal to animal, with special reference to the closeness of the exposure required to transmit the disease; also concerning the transmission of tuberculosis from truly tuberculous species to other species which have no true epidemiological or epizootiological significance for the perpetuation or persistence of tuberculosis as a great plague. Experiments have also been made and are being continued relative to the kind and amount of disinfection necessary to make pens and stables previously occupied by tuberculous animals safe for healthy animals. This subject is of considerable practical importance, and it is hoped that an economical method of disinfection can be worked out which will eliminate the use of highly corrosive and intensely toxic substances.

Experiments are also being conducted relative to immunization against and the treatment of tuberculosis, and further investigations have been planned on the significance of the mutation forms that are produced by some strains of tubercle bacilli under various conditions.

INFECTIOUS ABORTION.

Further observations have been made on the occurrence of the bacillus of infectious abortion in the milk of cows, and it can now be asserted that no cow that has become infected with infectious abortion, though she has ceased to abort, can be regarded as giving milk that is certainly free from the abortion bacillus. The station's work shows that pasteurization of milk at 140° F. for 20 minutes kills all the abortion bacilli it contains.

A considerable number of tests at the station with tonsillar tissue and nasopharyngeal adenoid vegetations from human beings relative to the presence of the abortion bacillus gave negative results. The pathological character of the lesions led to the belief that they might be associated with the bacillus. A report of this work has been submitted for publication.

OTHER WORK.

During the year an investigation, which has been carried through several years, on the relative value of raw, pasteurized, and boiled milk as a food for unweaned animals was so far completed that a special report on it can be presented at an early date.

Various experiments have been in progress and will be continued relative to the symbiotic presence of two or more organisms in the bodies of animals.

During the year the usual routine work relative to raising small experiment animals, keeping animals exposed to infectious diseases in quarantine, testing commercial samples of tuberculin, etc., was done.

REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
Washington, D. C., October 31, 1913.

SIR: I have the honor to submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1913. Until March 18, 1913, when he became Assistant Secretary of Agriculture, the work was directed by Dr. B. T. Galloway, in continuation of his service as chief from the organization of the bureau July 1, 1901, until that date. During the remainder of the fiscal year the work was under the direction of the present incumbent, with Prof. L. C. Corbett, horticulturist, as assistant chief of bureau.

Respectfully,

WM. A. TAYLOR,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

GENERAL WORK OF THE YEAR.

The total appropriation by Congress for the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1913, amounted to \$2,667,995. Of this total \$427,690 was for statutory salaries and \$296,000 for the work in connection with the purchase and distribution of seeds, while the remainder, \$1,944,305, was appropriated specifically for various phases of research and demonstration work relating to crop production, disposal, and utilization. In addition to the foregoing, there was administered by the bureau the work provided for by separate appropriations of \$80,000 for investigating the bark disease of the chestnut tree, and of \$10,000 for the investigation of the production of potatoes and sugar-beet seed under irrigation.

The correspondence of the bureau is constantly on the increase, over one and one-quarter million letters, including multigraph letters, having been sent out during the past year in connection with the various activities of the bureau.

The publications, as heretofore, have been handled by Mr. J. E. Rockwell. New bulletins, circulars, etc., to the number of 119, con-

taining 3,800 pages, 222 full-page plates, and 631 text figures were issued during the year. The first editions of these publications aggregated 1,284,850 copies. Six papers were contributed to the Yearbook of the Department of Agriculture, and 22 Farmers' Bulletins were prepared and submitted.

In connection with the fiscal operations of the bureau, 7,400 requisitions for supplies were issued, 17,940 accounts were received and examined, 227 requests for contracts and leases were made, 2,955 letters of authorization and amendments thereto were drawn, and about 1,500 letters of instruction to field investigators were prepared.

From September 1, 1912, to August 31, 1913, the changes in the personnel of the bureau were as follows: Resignations, 416; deaths, 5; transfers from the bureau, 48; furloughs and terminations of appointments, 693, making a total of 1,162 employees dropped from the rolls during that period. There have been made in the same period 1,621 appointments, increasing the total force of the bureau by 459. On September 1, 1913, the numerical strength of the bureau was 2,729. The total number of employees in the bureau on the same date a year ago was 2,270.

The interchange of products between various producing areas and the constantly varying economic and crop conditions throughout the United States force upon the attention of the investigators of the Bureau of Plant Industry a diversity of new and difficult problems. In an annual report it is manifestly impossible to discuss in detail all the work in progress. Only certain of the more important problems and results are included in the following comments.

In the discussion the several features are grouped in accordance with their natural relationships rather than to conform to administrative or laboratory units.

PATHOLOGICAL INVESTIGATIONS.

The pathological work of the bureau has been continued during the year under the same personnel as last year, with Dr. Erwin F. Smith in charge of special bacteriological and pathological work, Mrs. Flora W. Patterson in charge of the pathological collections, Mr. M. B. Waite in charge of fruit-disease work, Dr. Haven Metcalf in charge of forest pathology, and Mr. W. A. Orton in charge of work on cotton and truck diseases.

Among the important achievements attained have been the staining of the crown-gall organism in the tissues of the tumor, an accomplishment not previously attained. Important results have also been obtained with regard to the relation of the crown-gall organism to animal tumors, and considerable light has in this way been thrown on the whole problem of investigation of cancer in animals.

The organism causing Stewart's sweet-corn disease has not heretofore been stained in the tissue, but during the year a method for accomplishing this has been perfected.

A new bacterial disease of sugar-beet and nasturtium leaves has been worked out, and a manuscript covering this work has been prepared.

An apparently new and destructive disease of water lilies has been discovered. A fungus has been isolated from the sick plants, and, by inoculation, this has been proved to be the cause of the disease.

Laboratory and field investigations on the destructive Central American banana blight have been conducted, and a bulletin dealing with that disease is being prepared. A number of new banana diseases have been discovered and work on them inaugurated.

During the year, studies have been made of the cultural characters of a bacterium causing leaf-spot of pelargonium, of the wilt disease of belladonna, of a bacterial disease of tomato, of the cultural characters of *Bacillus solanacearum*, and of various diseases of peas, corn, mulberry, and other plants.

FRUIT DISEASES.—The cedar rust or orange rust of the apple, which has its alternate generation on the red cedar, was unusually destructive during the season of 1912, especially in the Appalachian fruit belt, and resulted in severe losses to apple growers in the autumn of that year. The main facts about this disease have been worked out by investigators and known to science for several years. The remarkable increase of the cedar rust, apparently due to its new adjustment to the York Imperial and other commercial varieties of cultivated apples which has taken place within the last 8 to 10 years, has caused this to be the leading fungous disease of this fruit in certain apple-growing sections. Lime-sulphur solution, the standard fungicide for spring treatment of the apple, will kill the fungus, but on account of weather conditions and repeated infection periods during the time of leaf formation, it is difficult and usually impracticable to prevent the disease by spraying.

For several years the bureau has been recommending the destruction of cedars in the vicinity of large commercial orchards which they were injuring, as a result of which considerable cedar destruction has been accomplished. The unusually severe outbreak of 1912 and the poor results of spraying in that season, however, emphasized the necessity of cedar eradication more than ever before, and last year this was taken up more actively by the growers, particularly in Virginia and West Virginia, the department and the State experiment-station pathologists lending their aid and advice in the movement. The results of this work proved remarkably satisfactory during the spring infection period of 1913. In the valley of Virginia, where heavy losses were sustained the previous year, orchard after orchard recovered completely in a single season after having the cedars cut down within a radius of 1 to 2 miles. In order to insure thorough infection and thus make the effect of eradication stand out prominently, cedars were in some cases allowed to stand in the vicinity of certain orchards. From the results obtained in the work during the past year, it appears satisfactory to cut the cedars within a radius of 12 miles, even though hillsides were covered with cedars beyond that distance.

From experiments in the study of the mango anthracnose, which have been continued during the past year, it has been found that the anthracnose can be prevented by spraying with Bordeaux mixture if the weather is sufficiently favorable during blossoming time to permit the fruit to set.

During the past year the life history of the black-rot fungus of the apple (*Sphaeropsis malorum*) has been worked out by pure cultures from single ascospores, showing that it is a pycnidial form of *Melanops quercuum*, or a variety of it, and is practically identical

morphologically with the *Melanops* on grape and with that occurring on various other host plants.

CHESTNUT BARK DISEASE.—By means of material sent from China by Mr. Meyer, one of the explorers of the department, the theory previously held regarding the origin of the chestnut bark disease has been confirmed. Material sent from China reached the laboratories early in the season at a time when it was possible to inoculate it immediately into growing material and to secure a generation of the organism which proved to be not only pathologically the same as the one causing the destructive chestnut bark disease in this country, but giving the same physiological reaction. This discovery clears up the mystery which has surrounded the origin of this disease. In addition to this discovery the historical evidence gathered from records of the nursery trade shows conclusively that this disease has been brought into the country at several places in previous years upon stock imported from the Orient. The oriental chestnuts, however, are much less susceptible to the disease than the American, and it is to stock from eastern Asia that we must look for a continuation of the chestnut supply if no way is found to check the ravages of the disease. As a result of the loss of timber by this disease there has been a great quantity of dead chestnut timber to be utilized. Investigations have proved that trees killed by this disease are good for ordinary timber uses if utilized within two years after the death of the tree.

Studies of the distribution of the disease show that the critical territory is now Virginia and West Virginia, and that it is spreading most rapidly in a southwesterly direction in the narrow ridges of the Alleghenies.

WHITE-PINE BLISTER RUST.—This disease has recently been found established on mature native white pines in northern Vermont in very destructive form, which discovery effectually disposes of the view that this disease may not be aggressively destructive in America. Fortunately this was an isolated location, and the disease is now being eradicated. The annually recurring attacks of this disease on *Ribes* in the vicinity of Geneva, N. Y., have been explained by this discovery of diseased white pines in the affected area. Outbreaks of this disease on *Ribes* have also occurred at one point in Connecticut, one in Massachusetts, and one in Vermont.

The utter futility of inspection of all white-pine nursery stock infected with this disease has been further established by the discovery that the parasitic fungus may vegetate in the bark for at least five years before visibly affecting the tree. In consequence, it is recommended that all lots of imported white-pine nursery stock in which diseased trees have been found be totally destroyed, in preference to continuing the expensive and wholly uncertain system of annual inspection.

WORK IN THE NATIONAL FORESTS.—The work of the district pathologists, carried on in the National Forests in cooperation with the Forest Service, has been largely directed toward refining and improving the methods of marking and scaling, in order to avoid the expense of transporting defective logs from the forest to the mill

and to facilitate the operation of the "sanitary clause" in timber-sale contracts. This work apparently has been very fruitful of results.

POTATO DISEASES.—The appearance in a destructive way of several new diseases of potatoes in large producing areas has caused great alarm and heavy loss in certain of the important potato-producing districts of the Rocky Mountain territory. Among these maladies, heretofore unknown in this country, are leaf-roll, known in Europe for a number of years, curly-dwarf, rosette, and the mosaic disease. The attention of the pathologists in charge of this line of work has been devoted exclusively to a study of the causes and methods for controlling these troubles. As a result of the investigations a method has been worked out by which the resistance of the foliage of potato varieties or seedlings to *Phytophthora* may be tested in the greenhouse during the winter. This will greatly facilitate the work of potato breeding and will also furnish a method of determining whether seed potatoes are free from the disease.

The manner in which the late-blight fungus lives through the winter has been disputed for 60 years or more. It has now been fully proved that the infection is carried in the tubers which are held for planting.

Recent investigations have proved that the dry-rot of potatoes, which has been destructive in certain regions, is not caused by *Fusarium*, as was previously supposed, but that this disease is due to other wound parasites. The genus *Fusarium* has been shown to be divisible into sections and all the wilt-producing species fall under *Fusarium elegans*. The total number of species will be only a quarter of the present list, and these species can be distinguished by morphological characters. A monograph on *Fusarium* is in course of preparation and a complete set of exsiccatae is being brought together so that when the work is completed the results will be fully available to investigators.

SWEET-POTATO DISEASES.—The cause of the sweet-potato dry-rot has been determined, and methods of preventing it in storage are now under investigation. A new sweet-potato disease which has been called foot-rot has been partly worked out. The fungus previously believed to be the cause of wilt in sweet potatoes has been found to have no connection with this disease. The real parasite has been determined and its description is now ready for publication. Field experiments show conclusively that sanitary measures are most important in controlling these diseases of sweet potatoes and by this means very complete control has been accomplished in infested districts in New Jersey.

ASPARAGUS-RUST CONTROL.—The problem of controlling asparagus rust through the development of resistant strains is considered to have been solved.

DEMONSTRATION SPRAYING FOR TRUCK-CROP DISEASES.—The work of protecting cantaloupes, celery, and potatoes by the use of sprays has been conducted on an extensive scale at Vineland, N. J.; at Ocala, Manatee, and Hastings, Fla.; and at Arkport, N. Y. The increase in production of sprayed areas over those not sprayed has been conclusively demonstrated.

A new wilt disease of okra, due to the fungus *Verticillium*, which was previously confused with *Fusarium*, has been discovered and worked out.

A stem blight of pea, which has caused some loss, has been found to be due to a new species of *Fusarium*, *F. redolens*.

A fruit rot of tomato, due to a *Fusarium*, hitherto known only in Europe, has been studied. Another destructive fruit rot from Florida is being worked out, and tomato troubles in general are being given more attention.

FORAGE-CROP DISEASES.—In the cowpea breeding work a hybrid has been secured which is uniform, resistant to both wilt and root-knot and more erect and productive than Iron, also better adapted to use as hay. Several bushels of seed of this hybrid were grown during the past season and the variety will probably be ready for distribution in 1914.

SUGAR-BEET DISEASE INVESTIGATIONS.—The mycological side of the leaf-spot disease has been nearly worked out. The important discovery that the disease lives over only in the dead leaves and that siloing the beet tops will kill the fungus is expected to point out the way to better control by removing the source of infection.

CEREAL DISEASES.—The investigations on the life history of the head smut of sorghum have been completed and the results prepared for publication. The discovery of the complex method of reproduction of this smut is a distinct contribution to pathological knowledge. Cultural studies with rice affected by the "straight-heat" disease indicate that it is a physiological trouble which can probably be corrected by proper irrigation.

NEMATODE INVESTIGATIONS.—In a study of soil-infesting nematodes, prosecuted under the direction of Dr. N. A. Cobb, a large number of new forms have been discovered. It has been found that a new nematode, *Tylenchulus*, which was first found by one of the State investigators in California, exists also in Florida, Spain, Malta, Palestine, and Australia, indicating that it is undoubtedly a world-wide parasite and that it is peculiar to citrus roots. Experiments have been made to establish the main points in its life history, and considerable progress has been made in devising and testing methods of combating the parasite. A bulletin on the results of nematode investigations is about ready for publication. It is evident from the work thus far done that the number of species of nematodes is probably equal to the number of species of insects and that they constitute so important a factor in the growth and development of crop plants as to render their systematic and energetic investigation highly desirable from the economic standpoint.

PHYSIOLOGICAL AND BIOPHYSICAL INVESTIGATIONS.

During the year just closed more emphasis has been placed upon the plant-physiology work of the bureau than for several years past. The refinements which have been made in apparatus and in methods of recording plant phenomena have made it possible to study more problems in plant physiology quantitatively than has heretofore been the case.

The forces engaged in this work have been somewhat increased, but the general direction of it has remained the same and rested with Dr. R. H. True, in charge of drug-plant, poisonous-plant, physiological, and fermentation investigations; Dr. W. W. Garner, in charge of tobacco investigations, the more important problems in which are essentially physiological and nutritional; Mr. W. T. Swingle, in charge of crop physiology; Dr. K. F. Kellerman, in charge of soil bacteriology; Mr. T. H. Kearney, in charge of alkali and drought resistant investigations; and Dr. L. J. Briggs, in charge of biophysical investigations.

DRUG PLANTS.—The improvement and standardization of alkaloid-yielding plants has been continued, with especially important results obtained from belladonna. It now seems practicable, in the near future, to grow belladonna of any desired alkaloid content within normal limits of variation and also to secure uniformity of quality.

SWEET-POTATO CHANGES IN STORAGE.—Work on the behavior of the sweet potato during storage has shown that a definite course of changes takes place, varying chiefly with the temperature conditions of storage and ending sooner or later in weakening and decay. Full data on internal changes of carbohydrates have been secured, and work on other physiological features has been begun.

CHANGES PRODUCED BY THE MOLDING OF GRAIN.—The changes produced during the development of molds on grains have been given attention, it being shown that products of metabolic change due to the activity of the fungi produce substances sometimes toxic to animals. Since a large number of fungi thus attack food products, it is important to acquire definite information concerning the effect they may exert through substances which they may form. This line of study has been continued and broadened.

A thorough study of the oxygen relations involved in a series of potato and sugar-beet diseases has been carried on in cooperation with the Office of Cotton and Truck Disease and Sugar-Plant Investigations, with important results.

An important line of work inaugurated and operated during the year is a study of the minimal concentrations of inorganic salts in their relation to plant prosperity, for the purpose of getting additional information on the functions of these substances in the economy of the plant. The importance of a proper balance of salts has been long recognized as a general fact, but the physiological reasons for this fact are not understood.

DATE RIPENING.—The work of the winter of 1912-13 has proved beyond a doubt that the artificial ripening of dates such as the Deglet Noor may be carried on cheaply and efficiently merely by keeping the full-sized though immature fruit in a moist, warm condition. Fruit so ripened is cleaner and more attractive than that ripened on the tree. Thus the failure of the Deglet Noor to ripen on the tree as it does in some parts of the Sahara Desert, which at first seemed a great drawback to date culture in California, turns out to be an actual advantage, permitting the ripening of the fruit more uniformly and more efficiently than is possible in the open air, where the conditions can not be controlled.

DATE PROPAGATION.—The rapid propagation of date offshoots is a matter of great importance at this stage of development of the date industry. Experiments now under way indicate that it is possible to root offshoots much more rapidly under greenhouse conditions where they can be given bottom heat than by the Old World method of procedure. It is believed that by this method much smaller offshoots can be rooted. It has also been found that when grown in the cool, moist climate of the Pacific coast in immediate proximity to the ocean, certain varieties of the date palm fruit scarcely at all, but produce instead very great numbers of offshoots and continue to produce them through a much longer period of years than in typical date-growing districts. It is planned to transfer palms of the choice new seedling varieties to such localities in the hope of thus insuring a larger number of offshoots than could otherwise be produced.

NEW HYBRID SUBSTITUTE FOR THE LIME.—Another new hybrid, a substitute for the lime, fruited for the first time during the year. This is the limequat, obtained by crossing the West Indian lime with the kumquat. It has proved to be not only very precocious but also exceedingly fruitful and hardy. It bears a very acid fruit, much like the West Indian lime in size and flavor. The tree, however, is much hardier than the lime, having withstood the past three winters in extreme northern Florida where the lime can not be grown.

SMYRNA FIGS.—One of the most important discoveries in the growing of figs of the Smyrna type is that the caprifigs may be carried over winter indoors if packed in boxes alternating with layers of sand. This discovery assures to the fig grower a supply of caprifigs regardless of the severity of the winter.

The work of the past season has confirmed the value of the Abyssinian fig for use in caprifying the early, or "brebas," crop. This fig promises to play an important part in the future of commercial fig culture in the southwestern United States.

TOBACCO INVESTIGATIONS.—Tobacco investigations have been continued along the same line as last year in the Connecticut Valley, New York, Pennsylvania, Ohio, Kentucky, Tennessee, Maryland, Virginia, and the Carolinas. Work to date demonstrates the need of concise information regarding the fertilizer requirements of different types of tobacco on the particular soils to which these types are adapted. It has been found that a rotation in which special fertilizers are applied is of great importance in maintaining the character and burning qualities of the product.

In Maryland, Virginia, and the Carolinas the most important problem is the restoration of the much depleted supply of vegetable matter in tobacco soils through the use of cover crops which do not unduly increase the nitrogen supply. In the flue-cured districts the most significant feature of the fertilizer work has been the marked effectiveness of potash in preventing the spotting of the leaf, a trouble which, during the past season, has caused heavy losses to tobacco growers where insufficient quantities of potash were applied to the crop.

WATER REQUIREMENT OF PLANTS.—Further determinations of water requirement (ratio of water used to crop produced) have been made. The results give a valuable measure of the relative efficiency under

dry-land conditions of a large number of crop plants, and indicate the duty of water for these crops under different climatic conditions. The new strains of alfalfa, sorgo, and millet developed in the drought-resistance breeding work have proved to have a decidedly lower water requirement than commercial varieties of these crops.

The distribution of the plant associations in a representative area in the Great Basin region has been correlated with the soil-moisture and alkali conditions, and the usefulness of native vegetation in classifying land in that region with respect to its crop-producing capabilities, both with and without irrigation, has been established.

NODULE-FORMING BACTERIA.—In accordance with the policy of the last few years, pure cultures of nodule-forming bacteria for inoculating approximately 35,000 acres of leguminous crops were distributed during the fiscal year 1913. This distribution, while maintained on a rather large scale, is essentially for the purpose of studying the best methods of managing a distribution of pure cultures and thereby improving the effectiveness of the material distributed.

The use of pure cultures is perhaps the cheapest method of inoculating leguminous crops and avoids the danger of the dissemination of the crown-gall disease, which is occasionally caused by the shipment of old soil.

Investigations of the bacterial flora at Riverside, Cal., at Fallon, Nev., in the vicinity of Washington, D. C., and upon soil samples shipped from various parts of the United States have been continued. Especial emphasis has been given to studies related to the formation of humus; many new species of bacteria which are important in this regard have been described during the past year. Their relation to the fixation of atmospheric nitrogen and the nitrification of organic matter is now being investigated.

WATER REQUIREMENT OF CROPS.—One of the most important economic features involved in the development of the agriculture of any arid region is the selection of those crops and varieties which are most efficient in the use of water.

Water-requirement measurements are being conducted in western South Dakota, northeastern Colorado, and in the Panhandle of Texas with a view to determining the influence of the different climatic conditions prevailing in these regions on the water requirement of crops. The effect of climate is most striking, the water requirement of some of the crops grown in South Dakota being only one-third that of the same crops when grown in the Panhandle of Texas. This illustrates the futility of basing dry-farming operations upon rainfall alone.

ELECTROCULTURE EXPERIMENTS.—The electroculture experiments with wheat during the past year gave an increased yield of only one-half bushel per acre above that of the check plats. The increase in yield of the electrically treated plat in 1912 was less than 2 bushels per acre. None of the experiments of this bureau have so far indicated that electroculture is practicable from a commercial standpoint.

TECHNOLOGICAL INVESTIGATIONS.

The technological investigations have to do with the handling of agricultural products in the trade or in process of manufacture. The personnel in charge of these lines of work in the bureau during the past

year has not been changed, and consisted of Dr. N. A. Cobb, in charge of crop technology; Mr. C. J. Brand, in charge of cotton marketing and paper-plant investigations; Mr. L. H. Dewey, in charge of fiber-plant investigations; Dr. J. W. T. Duvel, in charge of grain standardization; and Mr. Edgar Brown, in charge of the seed laboratory.

COTTON-GRADE STANDARDIZATION.—The number of sets of cotton grades supplied to the public during 1912 was double the number issued the previous year, an indication of increased popular demand for the official grades. In addition to supplying the trade, 100 sets were issued to farm demonstrators to be placed with reliable organizations where daily quotations are posted, to indicate the value of the grades.

Samples collected at random from various parts of the cotton belt indicate that little cotton is offered which can not be readily classified on the basis of the present official grades. Investigations conducted to determine the limit of error in the average expert's estimate of the actual length of staple show that these errors range from one thirty-second to three-sixteenths of an inch, a fact which emphasizes the need for a standard of length determinations.

Investigations to determine the effects of storing cotton in the seed before ginning upon its strength and quality resulted in a marked improvement in strength of fiber in some lots and no injury to any. A repetition of the moisture tests with cotton shipped from southwestern points to New England corroborated the tests of last year, the result of which shows that such cotton gains about 2 per cent in weight.

The third annual opening of cotton samples stored in vacuum disclosed no deterioration of the sample, thus establishing the permanence of this method for storing official standards.

COOPERATIVE COTTON HANDLING AND MARKETING.—A new line of endeavor, which is an effort to make directly available to the producer some of the beneficial results of grade standardization, required the organization of producers in such a way as to permit of securing a product the history of which might be traced through every operation, movement, or transaction from farm to factory. This in turn required the organization of a community system of production so as to secure a considerable output of a single variety under similar conditions. A few bales of cotton are not sufficient to determine costs, or profit or loss factors, either in field handling, ginning, baling, or marketing. As a result of a preliminary inquiry, it was found possible to organize and conduct the work effectively in Oklahoma and in South Carolina. The studies were sufficiently extensive to be of decided value to the producers, ginners, and buyers, and enabled those in charge of the investigations to determine the approximate efficiency of the methods of attack.

From the field investigations carried on it is evident that the present transactions between grower and dealer are not on a rational, much less a true-value, basis. The dealings in a town for a single day during the height of the market season will serve as an illustration. Twenty-one lots handled and sampled showed a wide variation in grade, but the price paid varied only 1 cent per pound for the whole range in grade, and this difference did not correspond with the grade

of the cotton, for the lowest price— $11\frac{1}{2}$ cents per pound—was paid for a good middling bale—the best of the lot—while $12\frac{1}{2}$ cents per pound was paid for good middling spots. These two bales were the best offered, and the one which was of the highest grade brought the producer the lowest price, the second-best bale bringing the highest price for the day. All other grades fell within the limits of price paid for these two best bales. This illustrates the need for exact information regarding the relative value of different grades of cotton, both by the producer and by the dealer.

FIBERS OTHER THAN COTTON.—Experiments with hemp, continued in cooperation with the experiment station in Wisconsin, have demonstrated that the crop may be made to yield good profits, since the fiber has been successfully prepared by machinery. At the same time the crop will kill quack-grass, Canada thistle, and other weeds.

The results of the first year's cooperative experiments in north-western Minnesota, while by no means conclusive, give promise that fiber strains of flax may be propagated in this country without deterioration. It has been repeatedly demonstrated that fiber flax equal to the best produced in Ireland or Belgium can be grown in this country, but heretofore all fiber flax cultivated in the United States or Canada has been from seed not more than four generations away from Russia or Holland. Varieties improved by selection, grown in this country, will remove a serious handicap to the production of real American linens.

Experiments with ramie in several locations during the last year show that the plant will grow under irrigation on soils of rather firm texture, but not on light, sandy soils, and it has grown well on clay loams in Louisiana, Mississippi, and Maryland. In an experiment in decorticating the fiber, however, only 160 pounds of dry fiber (China grass) were obtained from about 16,000 pounds of green plants, including leaves, grown on 1.8 acres. This yield of only 1 per cent is too small to be commercially practical. Ramie fiber is being prepared from dry stalks in California, but this method can not be used in a humid climate.

CROP-PLANT PAPER STOCK.—The work with cornstalks as a raw material for the manufacture of paper has been practically completed, and a publication is in preparation dealing with the outcome of the tests. In addition to obtaining paper from cornstalks, a somewhat promising stock food has been extracted from the material before it is used for the manufacture of paper. The experiments along this line, however, are not yet completed.

While there are difficulties in the way of handling flax straw for paper making, it has been demonstrated that a fine white writing paper can be made, as well as extremely strong paper for wrapping purposes. Since there is strong competition among wrapping papers, it seems likely that the chief use of flax straw in the manufacture of paper will be found in the field of papers suitable for making strong sacks.

Besides these two leading lines of investigation, a test to determine the value of hop vines and twines for paper making, as well as the value of cotton stalks, has been the subject of investigation. The difficulty of blanching the bark of cotton stalks, which can not be

separated in the process of paper manufacture, is a practical obstacle to the use of this material. In view of the fact that hop vines and twines do not behave alike in the process of manufacture, if these materials are to be used some method of separation or a different treatment must be devised in order to utilize them.

SEED INSPECTION.—Forage-plant seeds have been examined for the presence of adulterants, as directed in the appropriation act for this department. Of the hairy-vetch seed collected, 53 per cent of the samples were found to be adulterated or misbranded as compared with 62 per cent last year. Redtop and Kentucky bluegrass seed were collected and will be reported on later.

The seed-importation act of August 24, 1912, has been enforced since the date of becoming effective, February 24, 1913. Of 247 lots of seed sampled by customs officers, 15 lots have been rejected as being unfit for seeding purposes within the meaning of the act. Ten of these lots were returned to the country of origin, three lots were recleaned and entered, and two cases are pending.

STANDARD GRADES FOR COMMERCIAL GRAIN.—During the year special consideration has been given to summarizing the available data relating to the marketing, handling, transporting, storing, and grading of commercial corn prior to the fixing of definite grades thereof. This work is now practically completed, and grade rules and specifications are being formulated with a view to their final promulgation. The necessary data are not available for the fixing of definite grades for the other grains, although the investigations are being pushed as rapidly as the funds will permit. In these investigations there has been very satisfactory cooperation with many grain exchanges and grain-trade organizations.

CORN-ACIDITY INVESTIGATIONS.—The investigations relating to the soundness of corn, as determined by the degree of acidity, were continued with very satisfactory results. It has been fully demonstrated that the acidity test furnishes a means of definitely and accurately measuring the soundness of corn and of determining its safety for storage or shipment. It has been established that the acidity of corn of good commercial quality should not exceed 22 c. c. (in terms of normal alkali), while corn with an acidity of 30 c. c. is distinctly of low grade and of inferior quality.

WHEAT STANDARDIZATION.—In addition to the analyses of samples of wheat representing the quality and condition of the crop thrashed and stored on the farm and as received at terminal markets, milling tests were made on approximately 500 samples of wheat of different classes and grades representing special experiments, and also wheat from several of the larger markets. These milling tests were further substantiated by nearly 1,300 baking tests. These milling and baking tests showed a wide variation in the value of the same commercial grade of wheat from different markets and also from the same market at different seasons of the year. Incidental to these investigations, it was found that a very high percentage of the soft Red Winter wheat of the crop of 1912 contained a considerable admixture of hard winter wheat and of spring wheats, especially of the variety

known as Velvet Chaff. This condition was brought about as a result of the limited supply of straight soft Red Winter wheat, which, at one time during the year, brought a premium of more than 20 cents per bushel over the hard wheats. In connection with the wheat-dockage investigations, milling and baking tests were also made on a considerable number of wheat samples containing known percentages of various inseparable impurities found in wheat, such as cockle, king-head, wild rose, wild pea, vetch, wild oats, etc. The results of these tests fully demonstrated that foreign material of this character very materially lowers the grade of the wheat from a milling standpoint.

RICE STANDARDIZATION.—In connection with the rice handling and grading investigations, a very interesting experiment was made with Honduras rice in determining the superior value of rice from the inside of the shocks over that from the outside and exposed parts of the shocks. The rice from the inside of the shocks yielded approximately 12 per cent more of the grade commonly designated by the trade as "fancy head" than was secured from the rice representing the exposed parts of the shocks.

AGRONOMIC INVESTIGATIONS.

The agronomic work of the bureau has been continued during the past year with Mr. C. R. Ball acting in charge of cereal investigations, Mr. C. P. Hartley in charge of corn investigations, Dr. O. F. Cook in charge of work on acclimatization and adaptation of crop plants, Prof. C. V. Piper in charge of forage-crop investigations, Prof. E. C. Chilcott in charge of dry-land agriculture investigations, Mr. C. S. Scofield in charge of western irrigation agriculture, and the work at the Arlington Farm directed by Mr. E. C. Butterfield.

HARD WINTER WHEATS.—In connection with the improvement of cereals, the extension of the hard winter wheats into the Pacific Northwest, where they are displacing the soft winter wheats commonly grown, has steadily continued in spite of the same type of opposition which the hard winter wheats met when introduced into the Great Plains area and which has more recently been met and overcome by the durum wheats. A study of methods of winter protection for wheat in the northern portion of the Great Plains area is in progress and already indicates the possibility of increased winter survival where protected by stubble or cornstalks.

DURUM WHEATS.—That the prejudice against these wheats has practically disappeared is shown by the fact that during the last year they have sold steadily at a premium of 1 to 6 cents over equal grades of northern wheat, which is the market standard.

CORN INVESTIGATIONS.—Another year's work has demonstrated the importance of careful selection, early gathering, and good preservation of seed corn. Better and more vigorous stands and greater and better yields have been secured by the use of such seed.

It has been observed that corns possessing heavy, tightly wrapped, and protruding husks have a considerable amount of protection against weevil and fungous damage in those parts of the South and Southwest where these troubles are prevalent.

POSSIBILITIES OF CHINESE CORN IN THE SOUTHWEST.—Repeated experiments have shown that the waxy type of corn recently introduced from China is often able to mature in the dry regions of the Southwest under conditions of drought that keep the larger varieties from making a crop. This remains true even when the Chinese corn is planted thickly, like sorghum.

INCREASE IN THE SIZE OF INDIAN CORN AS A RESULT OF CROSS-POLLINATION.—Experiments have been concluded affording definite evidence that the crossing of two varieties of maize is followed by an increase in the size of kernels in the same year that the crossing is done. The results from 11 carefully conducted experiments show increases ranging from 3 to 21 per cent. This increase is not to be confused with the increased yields secured in the year following, when the first-generation hybrid plants are grown.

CORN VARIETIES ADAPTED TO DEEP PLANTING.—In many parts of the semiarid region difficulty is experienced in securing a stand of corn. If the seed is planted near the surface, it fails to germinate for lack of water, while if planted deep it is unable to reach the surface. But in the varieties of corn that are grown by the Hopi and Navajo Indians of Arizona and New Mexico the germinating seedlings are able to force their way through as much as 16 inches of loose soil, making it possible to plant them at any desired depth. Work is now under way to combine the valuable adaptive characters of these Indian varieties with the deeper kernels and smaller cobs of our more improved sorts.

BARLEY.—The results of the past year prove that in the valleys of the northern Rocky Mountain region barley is not only a successful irrigated crop but is a most dependable dry-land cereal.

IMPROVED STRAINS OF RICE.—The improvement by selection alone of 14 strains of rice grown at the Crowley station in Louisiana have resulted in the development of rice superior to any now grown commercially in the United States. These improved strains have been distributed to the industry.

GRAIN SORGHUMS AND BROOM CORN.—Dwarf kafir has been extensively distributed through Federal, State, and commercial agencies and has proved to be a very desirable and profitable farm crop. Feterita, or Sudan durra, has awakened much interest as a desirable type of white durra. Both feterita and dwarf kafir are adapted to harvesting with the ordinary grain header, which adds greatly to their value as crops for extensive farming. Manchu kaoliang is now being grown in South Dakota as a field crop in competition with corn; and, although seasonal conditions have been more favorable to corn this year than in the past two seasons, kaoliang will probably again outyield corn in the western part of the State.

While the work with broom corn has been hampered for lack of funds, the department has taken a prominent part in the campaign now being waged for the planting of pure and viable broom-corn seed, and has received high commendation from the trade for its assistance in this work. Experiments with dwarf broom corn tend to prove that this crop is usually sown too thickly for best results.

STUDIES IN THE POLLINATION OF RYE.—These studies show that the crop is normally cross-pollinated and that when the heads are inclosed in paper bags before the anthers appear, either in the greenhouse or in the field, little or no grain is formed. Other experiments prove that rye pollen is carried by the wind to a distance of over half a mile under Atlantic coast conditions and prove the impossibility of keeping rye varieties pure by the methods commonly employed.

CEREAL FIELD STATIONS.—During the past year a new station was established at an elevation of 6,000 feet, near Cheyenne, Wyo., in cooperation with the Wyoming State Board of Farm Commissioners. This will serve the farmers of southeastern Wyoming, western Nebraska, and northeastern Colorado, at elevations of 5,000 to 6,500 feet.

Four field stations which were established last year have been brought under cultivation and fully cropped during the present year. The first is an irrigated rice farm at Biggs, Cal., on which will be conducted the experiments necessary to the investigation of rice production in the adobe soil of the Sacramento Valley. The second is located at an elevation of about 4,100 feet in the Harney Valley of southeastern Oregon, where frosts occur during all the summer months. It comprises a large area of dry land having no connection with the ground water, and a smaller area of subirrigated land. The conditions there represent an area 300 miles long in Oregon, together with adjacent portions of California and Nevada. The third station is located at Aberdeen, Idaho, in the Snake River Plains, and comprises both dry and irrigated land. It will serve the large number of settlers recently located on the numerous irrigation projects in that region as well as the large dry-farmed sections in the same valley. The fourth station completely established this year is the rice farm at Beaumont, Tex., which will serve the rice growers in the large area tributary thereto. The complete establishment of these farms has been attended with some unforeseen difficulties, but crops considerably above the average for the sections are being grown on each of them this season, due to the efficient service of their respective superintendents.

COTTON.—The discovery of the Durango cotton and other valuable new types as a result of explorations in weevil-infested regions of Mexico and Central America shows that this line of work should be continued until our farmers can be assured that they have been provided with the best types of cotton that can be obtained.

Of equal importance with the development of new varieties is the problem of preservation of varieties after they have been passed into cultivation. The first step toward the solution of this problem is a better organization of cotton-growing communities to produce commercial quantities of the same kind of cotton and avoid crossing in the field and admixture of seed at gins.

SUPERIOR VARIETIES OF COTTON.—Several improved varieties of cotton that have been developed and distributed by the Department of Agriculture continue to increase in usefulness and popular favor.

The Columbia cotton proves to be adapted to an extensive region and is being planted in larger quantities in South Carolina and adjacent States. Excellent results are reported also from Mississippi and Arkansas and from the coast districts of Texas.

The Foster variety has been distributed chiefly in the long-staple districts of northeastern Texas, Louisiana, Arkansas, and Mississippi, and is recognized as much earlier and more productive than the varieties of long-staple cotton grown in this region before the arrival of the boll weevil.

The Durango cotton, recently acclimatized from Mexico, appears to be better adapted than other long-staple varieties to conditions found in the irrigated districts of the Southwest, but is also being tested in other parts of the cotton belt. Even as far north as Norfolk, Va., an excellent yield of good fiber was obtained in the season of 1912.

The Lone Star cotton, a Texas big-boll variety, continues to show its superiority over other members of its class, which includes Triumph, Rowden, and other well-known sorts.

The Trice cotton, originated in western Tennessee, is the most promising of the early-maturing short-staple varieties and is giving excellent results across the entire northern rim of the cotton belt, from Texas to Virginia.

Several other new types, some obtained by acclimatization from foreign countries and others by crossing and selection from American varieties, are being studied and tested in numerous localities, but are withheld from general distribution until their superiority over the existing varieties is definitely known. Any undue multiplication of varieties is recognized as undesirable.

INCREASED PRODUCTION OF LONG-STAPLE COTTON.—The new early-maturing varieties developed by the department are being used as the basis of an increased production of long-staple cotton. The industrial demand is greater than the present supply and is likely to increase with popular appreciation of the superiority of long-staple fabrics in strength and durability. Excellent long-staple fiber can be grown in many parts of the cotton belt where only short staples have been planted in former years.

EXTENSION OF DURANGO COTTON CULTURE IN SOUTHERN CALIFORNIA.—The Durango cotton is being used as a basis of a new long-staple industry in the Imperial Valley of southern California. The first field of Durango cotton there was grown in the season of 1911. In 1912 about 200 acres were planted, and in 1913 about 5,500 acres, this requiring the total supply of available seed, including all that the California planters could buy in Texas. As the Durango cotton is even more productive than the short-staple varieties formerly grown in the Imperial Valley, it seems likely to replace the short-staple varieties altogether in that district. The problem of the future is to maintain the uniformity of the stock and develop supplies of pure seed.

THE LEAF-CUT DISORDER OF COTTON SEEDLINGS.—This disorder is responsible for enormous damage to the cotton crop by retarding the growth of the young seedlings and causing the permanent deformity of many of the plants. A circular has been published showing how to distinguish leaf-cut injuries from the leaf-curl caused by plant lice, and how to secure partial protection by closer planting and later thinning. The causes of leaf-cut have been located in exposure to extreme conditions in the early stages of growth, but further experi-

ments are needed to determine whether cold or heat, light, drought, or wind is chiefly responsible, and also to ascertain which methods of protection are most effective in different regions. As some varieties are more susceptible than others, it becomes necessary to investigate this factor in its relation to breeding and selection.

† AN IMPROVED SYSTEM OF COTTON CULTURE.—Further experiments in the control of branch formation in cotton have shown that greatly increased yields can be secured. When the vegetative branches are suppressed there is a better development of the fruiting branches of the lower part of the main stalk and the crop matures earlier in the season.

ABORTION OF FRUITING BRANCHES IN COTTON.—A study of the factors that determine the yield of cotton shows that there is competition between the two kinds of branches on the same plant, as well as competition between the separate individual plants. The development of vegetative branches not only interferes in several ways with the development of fruiting branches, but there may be an actual aborting or shedding of fruiting branches when the plants become too luxuriant. These facts may be considered as further reasons for the use of cultural methods of restricting the growth of the plants and inducing the development of fruiting branches early in the season.

‡ ALFALFA.—The breeding of improved varieties of alfalfa, especially hardy and drought-enduring strains, has developed new possibilities through the finding of forms of yellow-flowered *Medicago falcata* that produce new plants from true lateral roots. Certain of the forms that possess this character are good forage types, and it is hoped that by hybridizing them with selected plants of common alfalfa (*Medicago sativa*) an extremely vigorous and aggressive strain will result. The possibilities of the whole group of *Medicago falcata* increase with our knowledge of their requirements and characteristics, and also with the introduction of new forms. Promising strains have already been developed from this species and its hybrids with common alfalfa.

As a result of the recent introduction of new lots of seed of Peruvian alfalfa, the chances of establishing this variety in the Southwest are becoming extremely favorable. Peruvian alfalfa has so thoroughly demonstrated its value as a quick-growing strain for warm climates that little difficulty is anticipated in getting it thoroughly established as soon as the seed is placed on the market.

GRASSES.—Sudan grass has continued to demonstrate its high value for the semiarid regions, and even in the humid regions has given exceedingly satisfactory results. Extensive experiments are being continued with this grass, and arrangements have been made so that sufficient seed will be grown for all demands. In view of the great interest in the subject, a preliminary publication dealing with this grass has been issued.

Rhodes grass continues to show its high value for Florida and Gulf-coast conditions, but much disappointment has resulted from the poor germination of imported seed. American-grown seed in this respect shows very great superiority, and it is hoped that within a year or two sufficient home-grown seed will be produced to meet the demands.

The fertilizer experiments, conducted with a view to eradicating broom sedge and other troublesome pasture weeds, have given such excellent results that this work will be enlarged at the earliest possible date. As a result of two applications of certain commercial fertilizers, it has been possible to eradicate heavy stands of broom sedge in two seasons, and to greatly increase the growth of clover and pasture grasses.

SOY BEANS.—The varieties introduced from northern Manchuria succeed well in South Dakota, and it is believed that their introduction will extend northward the area over which this crop can be profitably grown. Large fields of soy beans are now being planted, especially with a view of seed production for oil. In connection with the testing of the varieties, some breeding work is being done. Some of the hybrids have proved so promising that they are now being propagated on a commercial scale.

COWPEAS.—The cowpea investigations, especially in breeding, have resulted in the production of a considerable number of exceedingly promising new varieties, some of which, especially from the viewpoint of seed production, are apparently superior to any of the standard varieties.

VETCHES.—Interest in the cultivation of vetches, especially the hairy vetch, continues to increase, and there is probably now a greater acreage grown than ever before. In many parts of the United States seed is now being grown successfully. One difficulty in the production of hairy-vetch seed, which ordinarily must be grown with a small-grain crop, has been the separation of the seeds. By means of the spiral seed separator, a European invention, this can easily be accomplished, and these machines are now available to American farmers. There is reason to believe that within the near future sufficient American seed will be raised to meet the demands and probably reduce the price of seed much below what is at present asked.

The purple vetch, a recent introduction of the department, is especially promising, inasmuch as it yields as much hay and more seed per acre than the common vetch.

JAPANESE SUGAR CANE.—A forage plant of considerable value in Florida and the Gulf States is the Japanese sugar cane, introduced about 20 years ago, the forage value of which has been more and more appreciated in recent years. This variety is perennial and continues to ratoon for 12 years or more. Recent introductions from Japan show that there are a number of distinct Japanese varieties, all apparently equal in hardiness to the original introduction and some of them superior in erectness and growth.

SUGAR-BEET SEED.—At Madison, Wis., during the past year, an exceptionally fine crop of seed was grown. A large number of beet families were tested exhaustively, nearly 40,000 analyses of individual beets having been made. This work indicates that the principal difficulties in the way of American seed growing can be overcome. Early planting is necessary to get a good seed crop, and machines for planting the beets and harvesting the seed are under trial.

DRY-LAND AGRICULTURE.—Work has been established at two new stations, the Northern Great Plains Field Station at Mandan, N. Dak., and the Cheyenne Experiment Farm at Archer, Wyo., under the joint supervision of the Office of Cereal Investigations and the Wyoming Board of Farm Commissioners.

NORTHERN GREAT PLAINS FIELD STATION.—The appropriation act for the fiscal year ended June 30, 1913, contained an item of \$50,000 to be used "for the purchase of land and equipment and the construction of buildings necessary to establish, equip, and maintain an experimental farm in the northern section of the Great Plains area, to demonstrate the kind and character of plants, shrubs, trees, berries, and vegetables best adapted to the climate and soil of the semiarid lands of the United States." This appropriation was expended for the purpose enumerated in the act, \$9,873.70 having been expended for the purchase of 315.79 acres of land adjoining the city of Mandan, N. Dak., with the stipulation that an adjoining 320 acres of land be deeded to the trustees of the North Dakota Agricultural College without expense to the department, and that a continuing lease of the same for a period of 99 years, at the option of the Secretary of Agriculture, be executed by the said trustees to the United States for the use of the Department of Agriculture. There has, therefore, been made available to the department 636.79 acres of land for the Northern Great Plains Field Station, at a total cost to the Government of less than \$10,000. The remainder of the \$50,000 has been expended for the construction of buildings, the purchase of equipment, and the payment of salaries, and other expenses necessary for the establishment, equipment, and maintenance of the station.

COOPERATION IN DRY-LAND AGRICULTURE WITH OTHER OFFICES AND WITH STATE EXPERIMENT STATIONS.—The cooperative work described in previous reports at eight State substations, at three field stations operated by the Office of Western Irrigation Agriculture, and at one field station operated by the Office of Cereal Investigations, has been continued in a very satisfactory manner and under the same general plans outlined in previous reports. Additional cooperative work has been inaugurated at the Cheyenne Experiment Farm, operated by the Office of Cereal Investigations near Archer, Wyo.; and arrangements have been made for inaugurating cooperative work with the Kansas Agricultural Experiment Station at the new substation to be established near Colby, Kans.

WESTERN IRRIGATION AGRICULTURE.—During the past year the first results have been obtained from the rotation experiments on irrigated land which have been inaugurated on the field stations located at Scottsbluff, Nebr., Bellefourche, S. Dak., and Huntley, Mont. These rotation experiments have been very carefully planned with a view to determining by actual field tests some of the important questions involved in the problem of sustaining the productivity of irrigated land. This is the first comprehensive attempt ever made in this country to attack this problem by careful field investigations.

The experiments cover about 25 acres of land on each of the field stations, and involve between 75 and 85 plats of one-fourth acre each.

LONG-STAPLE COTTON IN THE SOUTHWEST.—One of the important features of the cooperative work of the Office of Western Irrigation

Agriculture during the past year has been the successful result of the effort to establish the production of long-staple cotton in the Salt River Valley in Arizona and in the Imperial Valley in California.

In the season of 1912 a number of farmers in the Salt River Valley, acting on the suggestion of this department, produced nearly 500 acres of Egyptian cotton, which yielded approximately one bale per acre, and which sold for about 21 cents per pound f. o. b. local points. The results of this demonstration were so satisfactory that a larger number of farmers planted the crop this present season, and the aggregate area devoted to Egyptian cotton in the present season amounts to nearly 4,000 acres.

ARLINGTON FARM.—The improvement of the farm has been continued along the same general lines as in the past, special attention having been given to the installation of large main drains.

FARM-MANAGEMENT STUDIES.

The work of farm management, directed by Prof. W. J. Spillman, has been greatly enlarged and its usefulness increased during the past year by the readjustment of certain features, with a view to obtaining and making available as promptly as possible authentic information needed by the rapidly increasing number of men who are engaged in carrying the results obtained from studies of farm practices and scientific experimentation to the average farmer. Much of this work is definitely planned and prosecuted with a view to obtaining useful and interesting material for the men who are to help the farmer through the elimination of waste and the increase of farm efficiency, so as to enable him to secure maximum returns for his labor and investment. In the Northern and Western States this work is closely associated with farm demonstrations, through which the results are made immediately available to the farmer.

COST ACCOUNTING.—The farm cost-accounting work brings out the fact that the overhead or general farm expense is surprisingly large. It also shows that on general farms approximately one-third of the farmer's time is spent on crops, one-third on live stock, and one-third on general work, much of the latter being labor of an unproductive nature.

Records of the business status of about 1,400 farms were obtained. These surveys, taken in widely separated localities and under widely varying conditions, seem to indicate that the same factors require consideration in accomplishing the successful operation of any farm. These are (1) the size of the business, (2) the diversity of the business, (3) the quality of the business, and (4) the adaptability of the type of farming to local conditions.

These surveys also furnish a suitable basis for a comparative study of the relations existing between landlord and tenant, and of the relative profitableness of farms operated under different systems of tenure.

FARM EQUIPMENT.—These studies include carefully collected data relative to the building and machinery requirements on farms of varying sizes and conducted under different systems of management.

TENANT FARMING.—This study has been continued with the basic purpose of determining the proportion of the income that should go to labor, to working capital, and to the investment in real estate. Use is being made of records taken in the farm-management surveys as a means of comparison between different systems of tenant farming.

AGRICULTURAL GEOGRAPHY.—The shifting of crop areas from period to period, as indicated by statistical data gathered by the Bureau of the Census and by the Department of Agriculture, is clearly shown by graphic charts and by maps which are being made indicating the distribution and intensity of crops at various times during the history of the country. These maps are of great educational value in that they show the movement of the crop areas and indicate changes which take place as the result of the changes in transportation and other economic factors.

FARM DEMONSTRATION WORK.

While many phases of the various lines of work prosecuted in the Bureau of Plant Industry necessarily have for many years included demonstration features through which improved methods developed either by practical farmers or as the result of scientific investigation can be promptly projected into agricultural practice, the systematic organization and prosecution of farm demonstration work is a comparatively recent development. Begun in the Southern States under the direction of the late Dr. S. A. Knapp with a view to meeting the exigency caused by the advent of the cotton-boll weevil, the work has grown rapidly throughout the South and more recently has been undertaken in the Northern and Western States. This work in the Southern States is prosecuted under the direction of Mr. Bradford Knapp and in the North and West under the direction of Prof. W. J. Spillman.

DEMONSTRATION WORK IN THE SOUTH.—The work in the Southern States, which is prosecuted by Mr. Bradford Knapp in the Office of Farmers' Cooperative Demonstration Work, included 920 persons at the close of the fiscal year. Of this number 721 were engaged upon adult demonstration and boys' club work and 199 were engaged upon girls' canning and poultry club work. The extent of cooperation supplied by local communities and by the States in which this work is conducted is indicated by the fact that of this number but 486 were paid entirely from Government funds, the remaining number being financed from General Education Board funds and by local cooperating agencies.

The work of the agents was distributed among 102,718 adult demonstrators and cooperators and 95,641 boys in corn, cotton, and kafir clubs and 33,060 girls in tomato-club work.

For the crop season of 1912 accurate reports were received from 29,593 adult corn and cotton demonstrators, reporting on 212,484 acres. This is the largest number of reports and the largest acreage reported during any year. The average yield on these demonstration farms was 1,054.8 pounds of seed cotton and 35.4 bushels of corn per acre. The average for the States, according to the Bureau of Statistics was 579.6 pounds of seed cotton and 19.6 bushels of corn per acre.

In the boys' demonstration work a much greater number of final reports were received than ever before, and the general average was considerably higher. The highest average yield in the boys' work was in Tennessee, where 731 boys reporting averaged 91.46 bushels of corn per acre; the second highest in South Carolina, where 400 boys averaged 68.79 bushels per acre; the lowest in Texas, where 289 boys averaged 38 bushels per acre. In the various States 480 boys produced yields of over 100 bushels of corn per acre. Three boys in Mississippi and one in South Carolina produced more than 200 bushels of corn to the acre. Alabama boys won the trophy offered by the National Corn Exposition, the records of their team of 20 averaging more than 160 bushels of corn to the acre.

The severe drought over much of the territory caused many girls in the canning and poultry clubs to become discouraged and drop out. Notwithstanding, a great number persevered to the end and made excellent yields. From the product of her one-tenth acre, the prize winner in Virginia canned 3-pound cans to the number of 2,710, while many others canned from 1,000 to 1,800 cans. The average profit made on their one-tenth acre by all the girls reporting in 12 States was \$21.98. Several girls made a profit of nearly \$100. Home canning has been given a great impetus by this work, resulting in the saving of immense quantities of fruit and vegetables that have hitherto gone to waste. Numerous adult canning clubs have been organized by the mothers and instructed by the canning-club agents when giving canning demonstrations for the girls.

WORK IN BOLL-WEEVIL TERRITORY.—The boll-weevil infestation in the spring of 1913, in many parts of the territory, was heavier than it has been in any year since 1909. Cotton acreage had been greatly increased because of lessened weevil damage during the previous two years. There was great danger that farmers would become demoralized by the unexpectedly heavy emergence of weevils, and to some extent this was true in certain portions of the territory. Every effort was made to encourage the farmers to make the necessary fight against the weevil, and it is believed that the methods recommended by the department for the growing of cotton under boll-weevil conditions were more generally adopted than ever before. Even in southern Mississippi, where farmers have been greatly demoralized for several years, reports indicate that a splendid fight was made. As a result of this fight and of comparatively favorable seasonal conditions, the weevil damage will be far less than was anticipated in the early part of the season. In Alabama and in Florida there has been little of the demoralization that usually follows the advent of the weevil. The farmers generally have been well informed as to the necessity of following the department's instructions and have generally done so.

COOPERATION.—Cooperation with States, counties, agricultural colleges, schools, boards of trade, and private citizens has continued. The amount of money received from such sources increases with each year. During the past fiscal year the total amount of aid received from States, counties, and local sources was \$309,690.40. There is no more conclusive testimony to the value of the demonstration work than the fact that the longer the work is conducted in any State the more willing the local people are to bear a large share of the ex-

pense. More than half the salary of all local agents in Texas and Arkansas during the past year was borne by the counties, and it is expected that they will increase their appropriation for the ensuing year in order to make possible the payment of larger salaries to competent men and their employment for a longer period in the year. In Oklahoma, the Eastern Oklahoma Agricultural Association was formed in February for the express purpose of cooperating with the department in placing agents in every county in the eastern half of the State. Branch associations have already been organized in 15 or 20 counties in each one of which the association is paying \$600 per year toward the salary of the local agent.

DEMONSTRATION WORK IN THE NORTH AND WEST.—For demonstration work in the North and West an increased congressional appropriation of practically \$160,000 became available August 10, 1912. It was deemed desirable to organize this work so as to reach as many farmers personally on their farms as possible. Not only the adults but the farm boys and girls are included. The work is therefore divided into (1) demonstration work with adults and (2) boys' and girls' club work.

COUNTY AGRICULTURAL AGENTS.—The general plan settled upon for reaching the real problems of the adult farmer and for getting before him the best information on agriculture available has been to make the county, or a like area, the unit for work. A man trained in the science of agriculture and familiar with its practical details from actual experience in farming is then located permanently in the county with his headquarters at some central point.

This trained man, known as a county agricultural agent, makes a careful study of local agricultural conditions, finds out what the real difficulties and agricultural problems of the section are, and then fits his teaching and demonstration work to meet those needs. He acts both as counselor to farmers desiring information along agricultural lines and as an aggressive propagandist in getting matters of agricultural interest and betterment before the farmers. His services are free to all farmers of the county alike.

Local work of this character from the first has been recognized as of mutual interest to the department and to the State in which it is located. In the efforts to carry out the idea, close cooperative relations in all cases have been established between the department and the States in which the work is conducted. The work of the local or county agent is directed through a joint representative of the department and the State, known as a State leader, who makes his headquarters at the State agricultural college, and all instructions from the department to the local agents are transmitted through him. In some instances State funds have been contributed to assist in a cooperative way in conducting this work, but in many cases funds are contributed by the counties or localities, either through the contributions of local organizations or through a county levy, some States having passed laws making it legal to levy a tax for the purpose of contributing to the support of the county demonstration agent. In handling the demonstration work the aim has been to make it timely and of immediate local significance.

A summary of the work of the agents in 30 counties longest established will serve to give a general idea of the county agents'

activities. In these 30 counties the number of farms visited for the purpose of improvement was 6,520. There were 1,825 farmers' meetings addressed, with an attendance of 130,829 people. Cooperation has been carried on directly with 2,398 farmers; 336 farmers selected seed corn; 1,568 followed directions in testing seed corn and planted 235,756 acres with tested seed. As a result of the agents' work 441 farmers are following detailed directions in the culture of 6,781 acres of corn, 394 farmers are following instructions in growing 2,386 acres of alfalfa, 460 in growing 3,623 acres of clover, and 113 in growing 5,457 acres of potatoes. As a result of the agents' influence 2,724 cows have been brought into testing associations and 6,700 orchard trees have been pruned and 5,675 sprayed. The agents have also made plans for 197 farms and organized 65 farmers' clubs with a membership of 1,427 farmers.

BOYS' AND GIRLS' CLUB WORK.—During the year six State cooperative agents have been in charge of boys' and girls' club work, and they have had the assistance of five collaborators. At present there is a total enrollment of 60,000 boys and girls in the Northern, Central, and Western States. These have been systematically organized into boys' corn clubs, girls' garden and canning clubs, potato clubs, sugar-beet clubs, poultry clubs, vegetable-garden clubs, etc.

The average yield per acre of all the corn-club members reporting this year was 74.5 bushels, with a net profit of \$25.55 per acre. Fifteen members made a yield per acre of 140 or more bushels, 61 made over 120 bushels, 426 made 100 or more bushels, 658 made over 80 bushels, and 1,078 made over 60 bushels.

BOTANICAL AND HORTICULTURAL WORK.

The work of the bureau along botanical and horticultural lines has been continued, as during the previous year, under the direct supervision of Mr. F. V. Coville, in charge of economic and systematic botany; Mr. D. G. Fairchild, in charge of foreign seed and plant introduction; Mr. A. V. Stubenrauch, in charge of pomological investigations; Mr. L. C. Corbett, in charge of horticultural investigations; and Mr. E. M. Byrnes, in charge of gardens and grounds.

BLUEBERRY.—The experiments in connection with the culture of the blueberry have been continued during the past year. Berries nearly seven-eighths of an inch in diameter have been grown in the greenhouse, and many thousands of promising hybrids are now in cultivation. Plants are brought into commercial bearing five years from the seed. The new method of propagation by "tubering" produces plants 18 inches to 3 feet high at the age of 18 months.

BIBLIOGRAPHICAL INVESTIGATIONS.—Large additions to the botany catalogue have been made, consisting in large part of the systematic indexing of scientific journals, such as the *Philosophical Transactions* of the Royal Society of London, the publications of the Danish, Norse, and Swedish Royal Societies, the *Kew Bulletin*, the *Agricultural Ledger of Calcutta*, and the *Annales du Musee Colonial de Marseille*.

ECONOMIC BOTANY OF MEXICO.—Preliminary studies of the custard-apples and their allies have been completed and new species and varieties have been introduced into cultivation through the Office of For-

eign Seed and Plant Introduction. In order to facilitate this work, the collections from the Gray Herbarium, Cambridge, Mass.; the New York Botanical Garden, New York, N. Y.; the herbarium of De Candolle, at Geneva, Switzerland; and the entire collections of Annona, from the Berlin Herbarium, Berlin, Germany, have been sent in for study.

FOREIGN SEED AND PLANT INTRODUCTION EXPLORATIONS.—During the year Mr. Frank N. Meyer crossed Siberia into northern China, securing seeds and plants of promising species and establishing contacts with plant breeders and experimenters with cold-enduring plants in Siberia and Russia. He discovered that the chestnut bark disease occurs in a mild form on the Chinese chestnut trees grown in the Chihli Province, east of Peking, and that a degree of resistance to the disease was shown by at least one species of Chinese chestnut.

The exploration trips of Mr. Aaron Aaronsohn in Egypt and of Mr. C. V. Piper in India, referred to in the last report, were completed during the year and resulted in important introductions. Mr. W. F. Wight's preliminary explorations in search of potato varieties and related species of *Solanum* in the little-known regions of the Peruvian and Chilean Andes resulted in the securing of a unique collection of forms for the potato breeder, including some most remarkable varieties.

PLANTS OF SPECIAL INTEREST.—Plants of special interest now growing in the propagating gardens of the bureau are Chinese wood-oil trees, jujubes, pistaches, Chinese peaches, Japanese cherry stocks, hardy elms, pines, bamboos, nectarines from Baluchistan, the Chinese haw stock for the pear, hybrid chestnuts fruiting at 18 months from the bud, and many other valuable forms.

The papaya, which heretofore has been grown only from seed, has been successfully grafted. There are indications that this discovery will put the papaya on a new basis as a fruit tree and make it possible to propagate and distribute named varieties of known desirable quality.

Young bamboo plants sufficient to enlarge the grove of Japanese timber bamboos by 5 acres have been successfully propagated from rhizome cuttings.

PROGRESS OF NEW INTRODUCTIONS.—The experimental plantings of the Chinese wild peach in California, Texas, and Iowa have shown this to be a very promising stock for plums, apricots, prunes, peaches, and almonds. It has shown remarkable precociousness in the desert region of southern California, resistance to drought in Texas, and hardness to extreme cold in Iowa, and an attempt is being made to get larger quantities of seed in China for extensive trials. The Rollinia, a valuable new fruit from Brazil, was fruited for the first time in Florida at the Miami field station, and it proves to be a valuable acquisition. From one 5-acre planting of dasheens in Florida, at the Brooksville field station, 700 bushels of this new root crop were harvested, and another 2-acre planting yielded 450 bushels. Sample packages for cooking trials were sent to 2,100 people throughout the South, resulting in a very large number of favorable reports—enough to indicate that a market can be created for this excellent new vegetable. A carload of the tubers was used in extensive cooking, forcing, and flour-making tests. For winter forcing purposes the dasheen

is unusually well suited, and the blanched shoots make a most delicate table vegetable. In order to determine how this crop is grown in the Tropics under irrigation, and whether it can be adapted to the southern rice lands in the same way that its near relative, the taro, has been adapted to the irrigated terrace lands of Hawaii, Mr. R. A. Young was sent to investigate the taro culture of the Hawaiian Islands. The Chinese pistache appears to be a congenial stock for the nut-bearing commercial pistache, aside from having attracted wide attention as a drought-resistant shade tree for the Southwest. Several of the large-fruited varieties of the dry-land Chinese jujube have borne fruits; and this fruit appears to have distinct commercial possibilities for Texas, California, and the Southwest, because of the unusual resistance to drought, cold, and neglect which the trees show.

The presence in Louisiana of large clumps of the Japanese edible bamboo with stems 40 feet high, originating from plants that were imported in 1902, and the rapid growth made by the two department bamboo plantations in Louisiana and Florida, have demonstrated this year the promising character of this valuable plant for farm plantings in the South.

FRUIT-MARKETING, TRANSPORTATION, AND STORAGE INVESTIGATIONS.—One of the most noteworthy results of the investigations is the extensive commercial application of the principles obtained in the table-grape storage investigations in California. The system of packing and storing table grapes devised by the bureau workers has become an important and permanent factor in the California table-grape industry. During the season of 1912-13 about 30 carloads of California table grapes were packed in redwood sawdust and stored in accordance with the results of the bureau investigations, and these were marketed at very satisfactory prices. Indications are that this system of marketing the fruit will receive wider application as the growers and shippers become more familiar with it.

A continuation of the shipping and precooling investigations with red raspberries from the State of Washington and with Loganberries from California has shown that careful attention to details of picking and packing, in connection with thorough precooling, will enable the shippers of these highly perishable fruits to considerably enlarge the area over which they may be distributed.

In connection with the precooling investigations, a means of utilizing a mixture of ice and salt for precooling has been devised. In this system air is circulated directly through the ice and salt mixture, with the result that the process of handling the refrigerating devices has been considerably simplified and added efficiency has resulted.

In Florida important preliminary results have been obtained from studies of the practicability of storing grapefruit. The work has demonstrated the possibility of picking grapefruit early and holding it for several months for later markets.

Preliminary studies of the effect of precooling on pineapples show that this process can be used to distinct advantage in that it will enable the growers to allow their fruits to reach a later stage of maturity than is possible under the present methods of shipping.

The comprehensive studies of the temperature of fruits while in transit in refrigerator cars make it evident that the type of refrigerator car at present in general use is not supplied with sufficient

insulation to maintain uniform temperatures in all parts of the load during excessively warm or excessively cold weather. As a result, the benefits accruing from precooling are largely lost, if not wholly nullified.

The investigations on the utilization of fruits in the manufacture of fruit juices have shown that the use of cold instead of heat for concentration results in a much more satisfactory product in some cases. The delicate flavors which are destroyed by the use of heat are not impaired when refrigeration is employed.

FRUIT-PRODUCTION INVESTIGATIONS.—Fruit-production investigations, formerly designated "Fruit-district investigations," have been extended to include Tennessee, Kentucky, West Virginia, and restricted contiguous areas in several States.

VITICULTURAL INVESTIGATIONS.—The Muscadine grape regions of the South Atlantic and Gulf States continue to yield results of much importance to this industry. Pollination, grafting, pruning, and training tests have been continued and extended; and important results have been obtained, especially from the pollination tests, in which the following conclusions have been reached: (1) Insects are probably the only agency in natural cross-pollination of Muscadine grapes. (2) Approximately 10 per cent of the bloom buds develop into fruit in a normal crop of *Rotundifolia* grapes. Through effective pollination this can be increased to 35 per cent. (3) Complete fertilization increases the size of the clusters and causes the berries to adhere better. (4) Summer dropping of Muscadine grapes results from imperfect fertilization, diseases, insects, and mechanical injury, weather conditions, etc.

FRUIT-BREEDING INVESTIGATIONS.—The study of the improvement of citrus and deciduous fruits through bud selection is yielding fundamental data of much importance to fruit growers. The observations of previous years indicating the inherent superiority of certain individual trees have been amply corroborated.

NUT-CULTURE INVESTIGATIONS.—Few systematic yield records of pecans under orchard conditions are available at the present time, but the results thus far obtained indicate that the estimates based upon the bearing of single trees growing under exceptional conditions are usually far above what can actually be accomplished under commercial orchard conditions.

IRISH POTATOES.—A leading feature of the potato work of the year was the exploration of that portion of South America to which the cultivated potato is supposed to be native. The result of this exploration is convincing proof that the potato was indigenous to the high Andes region of both Peru and Bolivia, where it has been in cultivation by the aboriginal people for 2,000 years or more. In addition, more than 250 sorts of cultivated and wild potatoes were secured, to be used in the development of more vigorous sorts especially adapted to the diverse areas over which the potato is cultivated in the United States.

SWEET-POTATO STORAGE.—The sweet-potato storage work carried on in Alabama and Mississippi, in addition to proving that sweet potatoes can be as successfully stored in the South as in the North, served as an emphatic demonstration of how to conduct such work.

PEANUT OIL.—The verdict of the investigations to determine the value of peanut oil for culinary uses is that this oil is the equivalent of olive oil of like grade.

CELERY STORAGE.—A test of a variety of types of crates for holding celery in cold storage resulted in demonstrating that the half crate or a partitioned standard crate is far superior to the regular 22 by 24 inch crate now generally used. Celery storage tests, while only preliminary, clearly indicate the superiority of a divided or half crate over the present California and New York standard crate for long-season storage.

PLANTS FOR THE GROUNDS.—Work with florist's crops included the following plants: Five thousand carnations in 7 commercial varieties, and 1,400 seedling plants resulting from crosses made during the past two seasons; 3,285 chrysanthemums, comprising 205 varieties, and 239 seedling plants made from crosses the previous year. The chrysanthemums were grown for the annual exhibition which was opened to the public on October 28, 1912. Later in the year, 568 hybrid amaryllis were in bloom at one time. The greenhouses were opened to the public during the duration of these flowers. This is the first time that any exhibition of flowers of this class has ever been made in Washington.

CONGRESSIONAL SEED DISTRIBUTION.

The congressional seed distribution has been continued under the same personnel as last year, with Mr. L. M. Estabrook in charge.

During the fiscal year 1913 there were distributed on congressional and miscellaneous requests 9,800,000 packages of vegetable seed and 2,250,000 packages of flower seed, or a total of 12,050,000 packages, each containing five packets of different varieties; 55,800 one-quart packages of improved varieties of cotton seed; 6,667 packages of improved tobacco seed; 21,200 packages of lawn grass and Bermuda grass seed; 1,800 pounds of sugar-beet seed; 11,500 boxes of imported narcissus and tulip bulbs; 26,100 grapevines, including 38 varieties; 92,700 strawberry plants, including 15 varieties; 3,500 hybrid citrange trees; and limited quantities of alfalfa, clover, vetch, cowpeas, soy beans, and sorghum. All of this seed was purchased on competitive bids, approximately 40 per cent from surplus stocks; the remainder being grown under contract for the department. Before acceptance by the department, each lot of seed was thoroughly tested one or more times for viability, seed grown under contract was inspected in the field, and a sample of each lot of seed was grown on the trial grounds of the department to determine its trueness to type.

As in former years, the vegetable and flower seed was packeted, assembled, and mailed by a contractor, the price last year being 94½ cents per thousand packets, which included hauling to the city post office or direct to the mail cars at Union Station.

The work of propagating Dutch bulbs at the garden near Bellingham, Wash., made satisfactory progress during the past year. Starting in 1908 with 170,000 bulbs, there were at the garden in the fall of 1912 approximately 1,000,000 bulbs of all sizes. The results secured in this garden are very encouraging. From five to eight years are required for the young hyacinth bulbs to mature, and until the hya-

cinths propagated in 1909 reach flowering size and are thoroughly tested, and until complete data are available regarding their cultivation and treatment, it is not likely that the department will be in position to give detailed information on the growing of these bulbs in this country. Tulip and narcissus bulbs mature much sooner than hyacinths. Some of the mature bulbs of these varieties which were propagated at the Bellingham garden, together with bulbs propagated near Portsmouth, Va., were tested last spring on the trial grounds of the department in comparison with bulbs imported from Holland. In every instance the American-grown bulbs gave stronger plants and larger and better flowers; and they were from a week to 10 days earlier than the imported bulbs of the same varieties. If similar results continue to be secured, it is believed that as soon as the facts are known the demand for American-grown bulbs will increase greatly, and that the bulbs will command a higher price and a readier sale than the cheap grades of foreign-grown bulbs now imported annually in large quantities.

The appropriation for the seed distribution for the fiscal year 1913 contained for the first time a definite provision for the purchase and distribution of drought-resistant field seeds. Using the mean annual precipitation as a basis for outlining the territory, the following States and portions of States were included in the district to be covered by this distribution: The western portions of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas; the States of Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona, and New Mexico; and the eastern portions of the States of Washington, Oregon, and California.

The appropriation became available on August 10, 1912, too late in the season to permit of having seed grown for distribution under contract, but through cooperation with other offices of the bureau and State experiment stations very satisfactory lots of alfalfa, broom corn, feterita, kafir, milo, millet, sumac sorghum, Sudan grass, corn, wheat, and field peas were obtained.

Sudan grass, a new wild sorghum recently introduced from Africa, and feterita, a grain and forage sorghum, also procured from the same country by the department, were distributed for the first time on a large scale. Sudan grass is extremely drought resistant and is well adapted to the whole region covered by this distribution. It makes a heavy yield of valuable hay, and promises to replace millet as an annual hay crop. Feterita is an early and very drought-resistant grain and forage sorghum, and is adapted to all but the northern part of the region. Only improved strains of the other crops were included in the distribution.

Approximately 27,000 packages of seed of drought-resistant plants were distributed, each package containing a sufficient quantity to plant at least 1 acre. This unit was selected with a view to enabling the farmer recipient to produce sufficient seed for his own use for future plantings from stock furnished him.

The results of this distribution, so far as reported, indicate that in this way the original intent of the seed distribution can be accomplished, namely, the introduction into practical agriculture of new and valuable crops needed in the improvement and development of agriculture.

REPORT OF THE FORESTER.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., November 11, 1913.

SIR: I have the honor to transmit herewith a report of the work of the Forest Service for the fiscal year ended June 30, 1913.

Respectfully,

HENRY S. GRAVES, *Forester.*

HON. DAVID F. HOUSTON,
Secretary of Agriculture.

THE NATIONAL FORESTS.

Presidential proclamations and Executive orders excluded from the National Forests last year 1,829,020 acres of land, and added 1,050,870 acres. The result was to leave within the National Forest boundaries on June 30, 1913, 186,616,648 acres, including 21,101,130 acres of alienated land.

COST AND RECEIPTS.

The following tables show the gross cost of administration and protection, expenditures for permanent improvements, and receipts from the several sources. The per-acre expenditures are computed on the basis of the gross area of all National Forests at the close of the year.

Expenditures for administration and protection and permanent improvements during the fiscal year 1913, compared with 1912.

Fiscal year.	Administration and protection.		Permanent improvements.	
	Total.	Per acre.	Total.	Per acre.
1913.....	\$4,621,275.91	\$0.0247	\$470,825.50	\$0.0025
1912.....	4,718,668.96	.0252	499,158.55	.0027

Comparison of receipts from the several sources for fiscal years 1913 and 1912.

Fiscal year.	Timber.	Grazing.	Special uses.	All sources.
1913.....	\$1,341,337.63	\$1,007,739.51	\$118,512.93	\$2,467,590.07
1912.....	1,089,702.04	968,842.26	98,812.27	2,157,356.57

Refunds of excess deposits (as, for example, deposits made by buyers of timber in advance of cutting) have not been deducted from the receipts given above. The refunds of timber receipts in 1913 amounted to \$65,781.15, and of all receipts to \$75,669.22. A deduction of the refunds would leave the total of receipts for 1913 \$2,391,920.85, as against \$2,109,256.91 for 1912. These figures show an increase in total receipts of \$282,663.94. The increase in receipts from timber, after deducting refunds, was \$225,585.46; from grazing \$37,880.21; and from special uses, \$19,198.27.

CLAIMS AND ALIENATIONS.

During the year 1,690 individual tracts of land in the National Forests passed into private ownership through the patenting of claims. Of these, 977 were homestead, 6 desert land, 35 timber and stone, 639 mineral, 24 coal, and 5 miscellaneous claims. Since the Forests are not subject to entry under the desert land and timber and stone laws, all claims of these classes were initiated before the Forests were proclaimed. The homestead claims were initiated partly before the creation of the National Forests and partly after, under the Forest homestead law of 1906. More homestead patents were issued than in 1912, due, no doubt, in part to the 3-year homestead law, which applies within the Forests as elsewhere.

The mineral entries and coal entries were initiated partly before and partly after the creation of the National Forests, since mining and prospecting and the patenting of mineral and coal lands proceed within the Forests precisely as though no reservation of any kind had been made.

For various reasons many claims never go to patent. While the overwhelming majority of entries under the different land laws have unquestionably been made in good faith, there are deplorable exceptions. There are also many abandonments. During the year 281 homestead entries, 8 desert-land entries, 41 timber and stone entries, 232 mineral entries, 2 coal entries, and 1 miscellaneous entry to land in National Forests were canceled by the General Land Office, usually upon hearings ordered by the Department of the Interior as a result of the statement of facts contained in the reports of the examining Forest officers. It should not be understood from this that any such number of contests have been held. The great majority of cancellations merely represents clearing the record of an abandoned entry. Often men who have filed on homesteads change their plans and go elsewhere, careless of the fact that their entries on the books of the Land Office remain intact until extinguished by formal action. The same holds true of other classes of entries. The settler who has made desert entry may conclude that it will not pay to reclaim the land, or perhaps he finds an improved farm which he

can buy for what it would cost him to build a ditch to reclaim the Government land. Timber and stone entries, mineral entries, and coal entries require the payment of a certain purchase price per acre before patent to the land is issued; often the entryman concludes to invest his money in some other way, usually neglecting to notify the Land Office and ask for the cancellation of his entry.

If the land covered by the claim is chiefly valuable for agriculture, action to clear the title makes it available for some man who does want it. Action may be the result of a contest initiated by a prospective settler, or of the expiration of the 7-year limit of time in which to make a final proof, or of a formal report of abandonment made by a Forest officer or special agent of the General Land Office. In every case an effort is made by the General Land Office to reach the former entryman and advise him of the proposed action, in order that he may protest against it if he so desires.

Canceled entries also include many cancellations made at the entryman's request or upon his voluntary relinquishment, where he finds other and more desirable land. It may therefore be said that the number of cancellations represents change of plans in many instances, lack of further interest in other cases, and a rear guard of fraudulent land-grabbers.

The overwhelming majority of attempts to secure land fraudulently were initiated before the land was withdrawn for Forest purposes. An awakened public conscience, better local sentiment, and clearer understanding of the requirements of the land laws, together with the presence on the ground of an administrative and supervisory force, have all worked together to reduce the number of land frauds. Yet, even to-day, there are in the aggregate a considerable number of individuals and corporations who seek to secure valuable Government property fraudulently, and have misused the land laws for that purpose.

HOMESTEAD CLAIMS.

There is very little fraud connected with the Forest homestead act, for the reason that the land is classified before being opened to entry, as fully explained later. The Forest Service does everything it can to aid the bona fide settler. Before the establishment of the Forests, many homestead entries were made for the purpose of securing valuable timber, which might ordinarily have been secured under the timber and stone act upon payment of \$2.50 an acre. Those who resorted to the homestead law rather than the timber and stone act for the purpose of securing heavy timberland were of two classes. The first class covers those who had already used their timber and stone right, and had therefore exhausted their powers to secure land under that act. Having obtained 160 acres of timberland under that act, the temptation was great to endeavor to secure an additional 160 acres of timberland under the homestead act. The second class of cases includes the men who resorted to settlement in order to secure a preference right. No land could be entered under the timber and stone act until surveyed and until the survey plats were filed with the local land office and the land regularly opened to entry; but unreserved land can always be taken by settlement. It therefore became a common custom for land cruisers to locate men on heavily timbered land either before or immediately after survey and before the filing

of the plats and the opening of the land to entry. A cabin would be built upon the land and some unsubstantial improvements erected. Then, when the land was opened to entry at the land office, the squatter was protected against losing out in the stampede. The man who took up land under the timber and stone act was required to swear that he had been upon the land and that it contained no improvements excepting such as had been built or were owned by him. The presence of a squatter's cabin upon the area would ordinarily prevent the filing of such an oath, and the fact of settlement would result, upon contest, in the cancellation of the timber and stone entry if made. Very often the squatter himself would join in the rush. If when he reached the land office he found a timber and stone filing had already been made upon the land, he would immediately tender homestead filing and start a contest, which almost invariably resulted in the timber and stone entryman withdrawing. If, however, the squatter found his land still open on the land-office books, he would file under the timber and stone act.

When the National Forests were created they contained a great number of squatters' cabins built not for the purpose of making a home, or even for the purpose of ultimately filing upon the land under the homestead act, but merely for the purpose of initiating prior rights against the day when they hoped the land might be taken under the timber and stone act. The great majority of these cabins were immediately abandoned, but in some instances the owners conceived that they might still beat the game by alleging settlement and continuing to claim under the homestead law. The complaints to the effect that the Forest Service has interfered with the homesteader and made settlement and development of land within the National Forests unreasonably difficult seldom arise because of contests involving land obviously valuable for farming purposes, but in large measure is the result of the complaints raised by men who have been unable to secure exceedingly valuable bodies of timber under the guise of settlement. Between December, 1908, and June 30, 1913, a total of 498 entries for National Forest land were canceled in a single administrative district. These entries represented fraudulent efforts to secure title to 85,906 acres of National Forest land for speculative purposes, involving nearly a billion feet of merchantable timber. During the last fiscal year alone 299,000,000 board feet of merchantable timber in one district was held in public ownership primarily because the Forest officers brought out the facts. This does not represent harsh dealings or pernicious activity. As evidence upon this point a few concrete cases are cited.

Homestead entry No. 03161, in the Coeur d'Alene National Forest, was canceled May 19, 1913, by the Secretary of the Interior. The claim contained 2,250,000 board feet of merchantable timber. The improvements consisted of an uninhabitable cabin, valued at \$60. The claimant's residence covered a period of 3 months in 1906 and a period of 4 months in 1907. During the rest of the time he made his residence in Spokane, Wash., approximately 45 miles from his homestead. One-third of an acre was partly cleared, but no crop was ever raised on the land.

Homestead entry No. 0276, Coeur d'Alene National Forest, canceled by the Commissioner of the General Land Office, contained 3,000,000 board feet of merchantable timber. The improvements

consisted of a log cabin valued at \$75. The claimant's residence was limited to 3 months in 1906. No land whatever had been cultivated. One-fourth of an acre had been slashed and the brush and logs piled.

Homestead entries Nos. 02531 and 02805, St. Joe National Forest, canceled by the Commissioner of the General Land Office, contained 4,000,000 board feet each of merchantable timber. No crops were raised on either. The improvements on the first consisted of a cabin valued at \$75, and the claimant's residence consisted of irregular visits to the land. He was employed by the Coeur d'Alene & Spokane Railroad Co. 50 miles from the claim. One-half acre had been partly cleared. The second claim was entered by a music teacher whose residence was limited to visits to the tract in the summer. One-half acre was cleared and seeded to timothy.

Homestead entry No. 01811, St. Joe National Forest, canceled May 12, 1913, contained 5,000,000 board feet of merchantable timber. Improvements consisted of two log cabins, one valued at \$100 and one valued at \$50. The claimant's residence consisted of periodic visits to the land prior to 1909. Since 1909 no residence of any character has been maintained on the claim. Approximately $1\frac{1}{2}$ acres of land were slashed, but not put under cultivation. The proprietor conducted a boarding house in a distant mining camp.

The foregoing are typical of a great number of entries contested by the Forest Service. They all represent attempts to consummate frauds initiated prior to the creation of the National Forests. The fact that the lands must now be classified before being opened to homestead entry precludes the possibility of such frauds being attempted hereafter. As attempted frauds under the mining laws are usually resorted to by interests in no way associated with mining, similarly the vast majority of homestead frauds are not chargeable to practical farming; but the appeal to popular prejudice has been made in the name of the mining industry and in the name of the farmers of the country. I am glad to be able to report that our relations, both with the men who desire to develop the mineral resources of the country and with those who desire to put to use its agricultural resources, are increasingly cordial.

MINING CLAIMS.

The mining laws afford the greatest cloak for land frauds in the National Forests, and have been more commonly misused than the other laws. This is because all land in the National Forests is open to mineral exploration and entry, and title can be secured upon proof of a certain amount of work and some mineral showing, together with the payment of a small purchase price per acre. Formerly the proof ordinarily consisted of affidavits submitted by the claimants, but since early in 1905 it has been the practice of the General Land Office, before issuing patents to National Forest land, to have a report from the Forest Service. The responsibility thus placed on the Service for preventing the consummation of fraud is met by field examinations, which are made only by men fully competent to testify as to the facts covered by their reports.

In justice to the mining industry, it should be repeated that the overwhelming majority of fraudulent mining schemes are initiated

by men and interests having no connection whatever with the mining industry. As a rule insistence upon compliance with the law works not hardship but benefit to miners. The mining laws were passed to promote their interests, and the special requirements of their business were kept clearly in mind. It is only in unusual cases that the best interests of either the mine or the miner would be served by going contrary to the law or beyond the limits which the law has set. Even when the law works against the interest of single individuals, its impartial enforcement is in the interest of the industry as a whole and of the public.

That the agitation of the alleged injustice done the mining industry by the National Forest system has been either inspired by motives quite distinct from the welfare of that industry or the result of misapprehensions has grown increasingly evident during the past year. The American Mining Congress has provided for the formation of State committees to take up cases in which injustice seems to have been done miners by Forest officers and lay them before the higher officials of the Service, or if necessary before the Secretary of Agriculture. A grievance committee appointed by the Idaho Mining Congress last year has presented but one case, and that was found to be a case in which no course other than that followed was possible under the law. Nevertheless, it is my strong hope that similar committees will be selected by the miners in every State in which their industry is of importance on National Forests, and that these committees will vigorously and consistently represent the interests of that industry in its relations with the Forest Service. One of the objects of the National Forests is provision for mining, on which so largely depends the prosperity of the West. That the Forests are in point of fact fulfilling these objects is attested by the miners themselves. Contributions to mining journals have pointed out during the past few months that had not the National Forest lands been reserved from private acquisition the field open to prospectors would even now be greatly diminished; that "wildcatting," generally recognized by miners as one of the severest handicaps under which the legitimate industry struggles, is curtailed by the refusal of patent to would-be vendors of worthless property; and that the Forests protect miners against extortionate prices for local timber.

It has often been asserted that the National Forests have operated as a bar to legitimate mining development. Figures collected in Colorado during the past year show that, if anything, there is more activity in prospecting on the Forests than on the public land outside. In an address before the Idaho Mining Congress at its Boise meeting last winter, the reasons for the comparative inactivity in prospecting—an inactivity which some have sought to ascribe to the effect of setting aside the National Forests—were analyzed by one of the speakers, a well-known mining man. This speaker gave as the principal causes the rise in the price of provisions and decline in the game supply, with the consequent great increase in the costliness of outfitting and living in the mountains; the change in the character of labor employed in mining, whereby the supply is now drawn very largely from races which lack the spirit of venturesome enterprise, independence, and fondness for nomadic wilderness life characteristic

of the prospector; and the difficulty in finding forage for pack animals which has resulted from the expansion of the grazing industry.

In a word, it grows steadily more apparent that the National Forests are not an incubus on the mining industry, but, on the contrary, an aid to it, just as it has proved an aid to the best development of the stock industry on the Forests, both in the interest of the industry itself and in the interest of the people who consume the product. As with the stock industry, the proper relations of the Forest Service with the mining industry should be cooperative. It is entirely suitable that matters in dispute between the Forest Service and individual miners, or matters of administration affecting the industry as a whole, should be adjusted through the instrumentality of an organization which the Service can regard as representative of the miners, and with which it can deal in a spirit of mutual fairness and regard for all rights and interests involved—both individual and public. In practical working, such a system will prevent further misleading of public opinion by claimants whose real grievance against the Forest Service is their inability to perpetrate frauds through misuse of the mining laws. Such fraudulent claimants are seldom bona fide miners. While frauds committed or sought to be committed in the name of the mining industry are legion, all but a very few of them are only remotely, if at all, connected with either mines or mining. This fact is illustrated by many examples.

Mining claims are located on the National Forests in order to get title to land valuable for town-site purposes; to land valuable because of scenic surroundings of world-wide fame; to land controlling timber sales negotiated by the Service; to sites for summer cottages; to land around watering places which gives control of sheep or cattle range; to land which controls mineral and medicinal springs; to valuable farms and agricultural land without complying with the homestead laws' residence requirements; to valuable power sites; to reservoir sites valuable for power and irrigation; to rights of way for power-transmission lines; and to sites for saloons and kindred enterprises not permitted upon National Forests.

TOWN-SITE MINING CLAIMS.—In one National Forest a placer claim covering approximately $2\frac{1}{3}$ acres was located in the vicinity of a surveyed town site in which it is understood that every lot has been sold and new arrivals are seeking outside ground for building purposes. The claim is reported to lie outside the mineral belt, and the examining officer reports that no valid discovery has been made. It is already occupied by several residents who hold possession under agreement with the locator. Land valuable for town-site purposes should be acquired under the town-site laws, not under the mining laws.

On another area, located near the Canadian line, an attempt was made to acquire, under the mining laws, a town site and control of the only available outlet in that region to the Canadian Provinces. A railroad operating through the United States and Canada has a right of way and one of its stations upon the land. After a hearing the General Land Office decided that the land in question has no value whatever for mining purposes and canceled the entry on July 13, 1912.

TIMBER MINING CLAIMS.—In another State claims were located obviously in anticipation of logging under purchase from the Government for the supply of mining timbers needed by a large and important mining enterprise. The three lode claims located in this instance contained 113.8 acres, or about 50 per cent more ground than is allowable under the Federal laws. The stakes on the ground were widely at variance with the boundary requirements of the mining laws, and did not agree with the paper locations in the county records. As the marking and cutting of mining timbers progressed toward these three claims, the locator maintained armed patrol along his boundary. A mineral examination indicated the lack of mineral discovery, and a hearing has been ordered by the General Land Office.

MINING CLAIM FARMS AND RANCHES.—The next case has a long history. A beautiful and fertile agricultural valley was covered with mining claims in 1886, which were sold a year or two later to an English syndicate. The land has been leased to tenants for agricultural purposes. All the examiners have testified uniformly to the essential agricultural character of the land. Careful pannings and assays show that the value of the concentrates ranged from 20 to 60 cents per ton. In the proceedings in the Federal court parties in interest describe the land as "valley land well watered and very productive." An English expert, in reporting to the syndicate on its property, referred to these placer claims as ranches "among the most beautiful and extensive of the company's farm lands, bearing crops of grain and clover hay that would not disgrace East Lothian." In the management of these lands the wisest course, it was said, was to sell a few lots from time to time and hold the rest as landlord. Although mineral location was made in June, 1886, application for patent was not made by the company until May 26, 1902, more than 15 years afterwards. On December 19, 1907, the General Land Office canceled the entry, but action is still pending against a relocation covering the same land.

A group of persons attempted to acquire, under the placer-mining laws, 640 acres of agricultural land in one of the prominent agricultural valleys of Montana. When patent was applied for an examination was made and the facts were reported to the Commissioner of the General Land Office. The claimants having failed after notice to file an answer to the charges preferred, the entry was canceled in April, 1913. The land under consideration had no value whatever for mining purposes, and the ditches excavated on the claims and reported as mineral development work were constructed for the purpose of irrigating the land.

In Bannock County, Idaho, an attempt was made to acquire a valuable tract of National Forest agricultural land, under the mining laws, by a large rancher and stockholder, solely for the purpose of grazing and to control the water. The location was finally declared invalid by the Commissioner of the General Land Office.

MINERAL SPRING MINING CLAIMS.—The administration of the act of February 28, 1899, granting authority to lease lands adjacent to mineral springs has been seriously hampered by the filing of mining locations on such lands. An application for the lease of such lands in one of the National Forests was made over two years ago, but the

consummation of the transaction has been held up owing to the time that must necessarily be consumed in having the mining locations on the land finally adjudicated. Some legislation should be enacted by Congress permitting the withdrawal of lands within a certain radius of such springs from all classes of entry under the public-land laws. At the present time an effort is being made to secure title to another very valuable mineral spring within a National Forest in Montana, through two locations under the placer mining laws. One tract is alleged to be valuable for building stone and the other for its supposed gold contents. The reports of three experts show that there is no evidence that gold or building stone were ever discovered within the confines of the claims. There are two applicants for the use of the mineral spring, who intend, if granted the privilege, to develop extensively the medicinal possibilities of the spring.

SALOON MINING CLAIMS.—The mining laws have frequently been resorted to by saloon men endeavoring to secure business locations within National Forests. During the construction of the Chicago, Milwaukee & St. Paul Railroad across the National Forests of northern Idaho on its way to the coast, a practice was made of locating saloon sites under the mineral laws at various points near the large construction camps, remote from police jurisdiction. In every instance it was shown clearly that the land located had no mineral possibilities, and the claims in question were declared invalid by the Commissioner of the General Land Office.

WATER-POWER MINING CLAIMS.—Mining claims are often located in order to secure valuable water-power sites. In one of the National Forests of California a mining claim was located on land alleged to be valuable for building stone. Later the claim was transferred to a hydroelectric power company which is already using National Forest land under permit in the development of hydroelectric power. The evidence went strongly to show that further utilization for power purposes was contemplated by the location of this claim. In a similar case in Montana a well-known hydroelectric power company sought to acquire, under the placer-mining laws, an important reservoir site by locating, through agents, some 1,630 acres of land along the basin of a certain river and its tributaries, so as to control the watershed. Immediately after the claim was located the agents of the company began the construction of the dam necessary to store the water. In other words, the claimants, who located the land under the placer-mining laws, immediately began construction work designed to submerge the area and make its mineral development impossible. Both these claims were canceled by the Secretary of the Interior. The second site is now used for storage purposes under an appropriate act of Congress.

A New Jersey corporation doing business in the State of Montana likewise attempted to secure a valuable reservoir site under the placer-mining laws through agents who, after locating their claims, constructed a reservoir but never attempted to develop the mineral possibilities of the land. The company applied for patent, but the application was rejected by the Commissioner of the General Land Office.

In Jefferson County, Mont., another well-known power company attempted, through its agents, to acquire title under the mineral

laws to placer and lode claims covering a strip of land approximately 15 miles in length, in order to obtain a right of way for its power-transmission line. The matter was taken up with the company, and, after much correspondence, it agreed that the right should be obtained in some other way, rather than under the mineral laws, and consequently it agreed to accept a transmission-line permit from the Forest Service, under the provisions of the act of March 4, 1911.

MINING CLAIMS FOR SHEEP-WATERING PLACES.—Sometimes the mining laws are misused in self-defense. A personal appeal to the Forest Service from a sheep owner in Nevada shows a case of this kind. This man has resided in Nevada since 1885, and has been in the sheep business for many years. For a long time he paid tribute to locators who had used the placer-mining laws to secure control of the water in practically all the creeks in that relatively arid region, for the privilege of crossing the mining claims to water at the creeks. The locations are admittedly worthless for mining purposes. Later he purchased all these locations, but for a number of years has been paying taxes and employing miners and others to perform the assessment work in order to prevent the land from being relocated and the range controlled. The stockman frankly admits that in all these years he has never secured a single dollar's worth of gold as a result of the work performed on these numerous claims. He now desires to be relieved of this incubus, provided he can secure any assurance of protection against similar fraud on the part of others. The land will be carefully examined and prospected by mining experts, and if the facts are found as reported, prompt action will be taken against anyone seeking to use the mining laws as a cloak for blackmail.

When the principle becomes firmly established and the fact widely known that the mining laws can not be distorted into an instrument of fraud, the good name and business standing of the mining industry will be greatly advanced.

LAND CLASSIFICATION.

Under the above head last year's report reviewed briefly the development of this work since 1909, and outlined the plans inaugurated for a systematic land classification to cover all the Forests affording any prospect of agricultural development within them. Before recording the progress made in carrying out these plans it is best to set forth the principles which govern the work.

Its purpose is to segregate and make available for the establishment and development of homes all National Forest land which will serve its best use by being brought under cultivation. The National Forests are set aside specifically for the protection of water resources and the production of timber, and their boundaries are drawn to exclude, so far as possible, land more valuable for agriculture than for forest purposes. This is, indeed, required under the spirit of the law which first authorized administration of the Forests; for that law expressly set forth that it was not the intent of Congress to authorize the inclusion of such land. It was recognized, however, that some areas of land chiefly valuable for agriculture would presumably be included and discovered later; for the law provided a carefully guarded procedure for administrative determination of

the true character of such lands prior to any contemplated elimination on this ground.

Because of the recognizedly nonagricultural character of the lands which, in the main, constituted, and would constitute, the National Forests they were exempted from the operation of the general homestead laws; but it was also recognized from the beginning that there would inevitably be included in such large areas many scattered tracts of land with cultivable soil. In the high and rugged mountain regions embraced in the National Forests, however, such areas of agricultural land are far too restricted to be dealt with through eliminations. Hence the Forest homestead law was passed. Under this law the small scattered areas within the Forests can, after classification as chiefly valuable for agriculture, be opened to entry. The law permits such lands to be taken up under a metes-and-bounds survey, and so enables their acquisition without the necessity of waiting for the system of public-land surveys to be extended to them.

Underlying the National Forest policy is the fundamental principle that forest lands must in the long run be handled under public control and that the public purposes served by these forests can not be secured under private ownership. On the other hand, lands chiefly valuable for agriculture should be developed under private ownership. The underlying aim of the work of land classification is to separate these two classes of lands and designate those which should be retained permanently for forest purposes and those which may be opened to private acquisition for homestead purposes.

The fundamental aim in administering the National Forests is to develop their resources for the permanent upbuilding of the country. The whole object of their administration would be defeated by closing the Forests to development and maintaining them as a wilderness. The aim of administration is essentially different from that of a national park, in which economic use of material resources comes second to the preservation of natural conditions on esthetic grounds. When National Forest land occurs which is chiefly valuable for agriculture, its free homesteading not only aids local development and advances the general public welfare, but also directly helps in the administration and development of the Forests themselves. The upbuilding of agriculture in the Forests where agricultural land occurs is on a par with the building up of industries through the use of timber, forage, and other resources of the Forests. The National Forests can not be developed properly without people. The usefulness of the Forests is in direct ratio to the number of people who use their resources. The presence of developed farms within the Forests aids in fire protection. Every cleared strip is a fire line; every ranch is a vantage point for fire fighting; every rancher may be made a forest protector. It is, therefore, the aim to further the agricultural development of all land which may be better used for growing field crops than for growing trees. Further, it is the aim and duty of every Forest officer to aid settlers in the Forests in the development of their farms by allowing free use of timber for domestic purposes, and in other ways.

The classification work must be governed by the fundamental purposes for which the creation of National Forests was authorized. One of these is water protection. Under no circumstances should land be released on which forests are necessary for this purpose. Such

in the Forest homestead law. This applies to areas needed for under Government control, but also the bottoms of narrow gulches, where the removal of the tree or brush cover would in the long run result in a scouring by flood waters, with disastrous consequences.

The work must also be governed by the necessity for retaining land areas, the use of which for administrative purposes will be required. The retention of such lands is specifically provided for in the Forest homestead law. This applies to areas needed for ranger stations; areas required for protective purposes, such as lookout stations; areas needed in the administration of timber, such as log landings and rights of way; areas needed in the administration of grazing, such as pastures and lambing grounds; and areas whose private acquisition would result in monopoly of other resources, or in other ways injure public interests. It certainly was not contemplated by Congress that the Forest homestead law should be misused to the public injury, nor that such misuse should be permitted.

Another necessary consideration is the creation of Forest units practicable to administer. It is fundamental that permanent boundary lines be secured as soon as possible. The objects of the Forests can be attained only under plans covering long terms of years. Every operation on the Forests has its effect on the future development of the timber. The location of the cuttings, the aggregate annual amount cut, the character of the operations with reference to reforestation profoundly influence the production of timber and the administration of the Forests in the future. In fact, this is true also of all the work of protection and improvement. It would be poor policy to overlook these considerations by attempts to practice forestry on lands which may be later excluded from the Forests. Money expended in forestry, forest protection, or improvements on such lands would be largely lost. The land classification now in operation will result in an early determination not only of the external boundary lines but of those lands within the Forests which must be retained permanently for forest production. At the same time, the classification designates the areas which are chiefly valuable for agriculture and which from every standpoint it is desirable to have settled up as soon as possible.

The work of classifying agricultural lands was undertaken on a much more comprehensive scale during the fiscal year 1913 than previously, as a result of a specific appropriation for that purpose. This appropriation amounted to \$25,000, and for the current year is \$65,000, with \$35,000 more for surveys of Forest homestead claims. The commencement of field work was delayed because the appropriation bill did not become effective until about a month and a half after the fiscal year began. In consequence many 1913 projects were carried over into the fiscal year 1914. In this report, therefore, I shall make reference in some cases to results which pertain to the current year.

The work includes (1) the classification of areas where the amount of land chiefly valuable for agriculture warrants an elimination, (2) the detailed classification of considerable areas, and (3) the examination and classification of single scattered tracts for which prospective settlers make application.

Under the first head fall the boundary surveys, which have been carried on for over four years and which have already resulted in

the elimination from the Forests of some 11,000,000 acres. The organization of the land-classification work, with the assistance now received from the Bureau of Soils and the Bureau of Plant Industry of the department, is enabling the rapid segregation of new areas. One result was the decision to eliminate from the Nebraska National Forest the entire North Platte division, comprising 340,000 acres. While this whole area is not agricultural land, such a percentage was found capable of cultivation that it was held best to eliminate all of it. In this particular instance no timber values were involved, because the Nebraska Forest was set aside in the sand-hill region for the purpose of building up a new forest by artificial means. It is believed that a sufficient area for this purpose has been retained in the portion of the Forest not opened. Another elimination, in the Rainier National Forest, will amount to 23,000 acres. In the Deschutes and Paulina National Forests, in Oregon, it was decided to recommend a revision of the boundaries which will eliminate 413,770 acres.

The detailed examinations which will result not in eliminations but in opening the agricultural lands for entry under the Forest homestead law are listed below. The acreage figures given cover the whole area under detailed examination, not the amount of agricultural land, which can not be stated until the work is complete. It will be seen that the areas examined will total about 3,000,000 acres, besides the elimination areas.

The examination of individual tracts or groups of tracts applied for by prospective settlers led to the listing of 2,639 tracts, aggregating 305,950 acres, during the year. Since the passage of the Forest homestead act of 1906 there have been listed for entry 13,061 individual tracts, with an area of over 1,400,000 acres. About 600 more tracts were listed in 1913 than in 1912. The work has been enormously facilitated by the general reorganization of the classification work made possible through the increased appropriations.

The following is a list of the classification projects:

Land-classification projects in the National Forests.

State.	National Forest.	Project.	Area.
			<i>Acres.</i>
Arkansas.....	Arkansas.....	Caddo.....	207,360
		Dutch Creek.....	138,240
		La Fourche.....	200,000
	Ozark.....	Blue Mountain.....	170,000
Total.....			715,600
California.....	Angeles.....	Cajon.....	135,000
		San Gabriel.....	175,000
	Cleveland.....	Laguna.....	165,000
	Klamath.....	Klamath River.....	80,000
	Lassen.....	Hat Creek.....	80,000
	Santa Barbara.....	Matilija.....	160,000
		Santa Clara River.....	75,000
Total.....			870,000
Colorado.....	Montezuma.....	Mancos.....	70,000
	Uncompahgre.....	Horsefly.....	67,000
	White River.....	Sweetwater.....	100,000
Total.....			237,000
Idaho.....	Kaniksu.....	Priest River.....	106,250
	Pend Oreille.....	District 5.....	151,680
Total.....			257,930

Land-classification projects in the National Forests—Continued.

State.	National Forest.	Project.	Area.
			<i>Acres.</i>
Montana.....	Blackfoot.....	Fortine.....	45,000
	Custer.....	Custer.....	443,215
	Flathead.....	North Fork.....	12,721
		Swan Valley.....	9,265
	Kootenai.....	Kootenai-Yaak.....	40,000
Total.....			550,201
Oregon.....	Deschutes.....	Metolius.....	31,360
		Sisters.....	49,167
	Oregon.....	Wamie.....	66,248
	Siskiyou.....	Rough and Ready.....	900
	Wenaha.....	Grande Ronde.....	21,120
Total.....			168,795
South Dakota.....	Black Hills.....	Reynolds Prairie.....	2,445
	Harney.....	Bear Creek.....	5,760
		Custer.....	70,000
Total.....			78,205
Washington.....	Columbia.....	Panther Creek.....	5,120
	Colville.....	Second West Branch.....	53,760
	Okanogan.....	French Creek.....	42,350
		Sweet Creek.....	48,532
		Twist River.....	12,070
	Rainier.....	Cispus River.....	6,400
	Siuslaw.....	Hebo.....	59,520
Total.....			227,752
Grand total.....			3,105,483

FOREST MANAGEMENT.

INCREASE IN TIMBER SALES.

There was a substantial increase in the amount and value of timber cut, and a much greater increase in the amount and value of the timber sold, largely for future cutting. The gain in cut was 15 per cent, in sale receipts 27 per cent, and in amount of timber sold 167 per cent.

In 1913 sales totaled over 2,000,000,000 board feet with a stumpage value of nearly \$4,500,000, as against less than 800,000,000 board feet with a stumpage value of \$1,600,000 in 1912. Eighteen additional blocks of timber, aggregating over 3,500,000,000 board feet and valued at nearly \$6,400,000, were approved for sale during the year. On these areas at least 13 contracts, involving approximately 2,500,000,000 feet, are practically assured. Tentative applications were on file at the close of the fiscal year for approximately 10,000,000,000 feet more.

URGENCY OF TIMBER ESTIMATES.

During the year timber cruising or reconnaissance was extended over 3,867,627 acres of National Forests. This work involves an estimate of the standing timber by small legal or natural subdivisions, with necessary surveys, the preparation of an accurate topographic map, and the compilation of detailed notes on the condition and character of the timber, the most practicable methods of exploitation, the extent and character of young growth, and other matters which affect management. These data are secured at a cost of from 3 to 10 cents per acre, depending upon the accessibility and topography of the region and the density of the timber. A total of

17,512,342 acres of National Forest land, or about one-eighth of the timber area, has now been cruised.

Cruising must be done before timber sales are made, in order (1) to settle any questions of title arising from the presence of patented lands or valid claims; (2) to determine whether cutting is advisable, and if so, under what stipulations; and (3) to fix the minimum price at which the stumpage should be sold. The expansion of the timber sale business depends upon the ability of the Forest Service to estimate and appraise the areas in demand. Every dollar spent must be drawn from the funds for administration and protection. These funds are inadequate. In district 1, which includes Montana and northern Idaho, at least two years will be required to estimate the areas for which sale applications are now on file. The condition in districts 5 and 6, embracing California, Oregon, and Washington, is similar, though less acute.

Timber estimates are the first step not only in making sales, upon which the Forest revenues mainly depend, but also in the preparation of working plans for the systematic development and use of all Forest resources. Such plans are being extended along the lines discussed in the report for 1912 as rapidly as the physical data required can be obtained.

This phase of National Forest administration is increasing in importance as use of the Forests increases. As long as the amount of timber in demand from particular Forests is small, intensive methods of forest management are necessary; but when the demand for timber bids fair to deplete the available supply on a Forest or group of Forests, a systematic plan of forest management becomes of prime business importance. Systematic plans are now becoming urgent on Forests like the Coeur d'Alene and Kaniksu, in the white-pine belt of northern Idaho, where the demand for National Forest stumpage is exceptionally keen; the Whitman in eastern Oregon, which is supplying a large local lumber industry up to approximately its maximum capacity; the Deerlodge in Montana, which is drawn upon heavily for local mining timbers; and the Black Hills and Harney in South Dakota, whose cut is rapidly increasing and will soon approach the maximum amount that these areas can produce. Working plans for such Forests are being developed and perfected as rapidly as practicable with present funds.

TIMBER SALE METHODS AND PROBLEMS.

The National Forest timber policy aims:

To prevent losses of this public property by fire.

To utilize the ripe timber which can be marketed.

To cut the ripe timber in such a way as to insure restocking of the land and the continuance of forest production.

To sell ripe timber at a price representing, as required by statute, the appraised market value and a proper return to the public which owns it.

To sell ripe timber in such a way as to prevent its speculative acquisition and holding.

To prevent monopoly of public timber and to use it as far as possible to maintain competitive conditions in the lumber industry.

To provide first for the requirements of local communities and industries, including free use and sale at cost to settlers as authorized by statute.

To make timbered lands of agricultural value available for settlement, under conditions which prevent speculative acquisition but encourage permanent and genuine farming.

To return as soon as possible the cost of protection and administration and to yield a revenue to the States, which are entitled by statute to 25 per cent of all gross receipts as an offset to the loss of local taxes through Government ownership of the Forests.

The necessity of preventing losses from forest fires requires no discussion. It is the fundamental obligation of the Forest Service and takes precedence over all of its other duties and activities.

The utilization of ripe, marketable timber, but without impairing the permanency or productivity of the Forests, is the second urgent duty of the Forest Service. Much of the mature stumpage, which approximates 60 per cent of the stand, is not deteriorating in merchantable value, but in portions an appreciable loss from year to year is taking place, although this loss has been grossly exaggerated and amounts to but a very small percentage of the annual yield. Uncut mature stumpage means both a reduction in the quantity and commercial value of the present mature stand, through decay, and a reduced production of wood through growth. Virgin forests are merely reservoirs of wood. Production can be secured only by converting them into thrifty, growing stands through cutting. The timber-sale policy aims, therefore, as the first requirement of good management, to work over the old stands on the National Forests, utilizing mature timber, reserving the young and middle-aged growth as far as possible, and putting the ground in such condition that forest production will be renewed at a much faster rate. Simple silvicultural provisions relating to the reservation of certain classes of timber and the disposal of slashings are incorporated in all sale contracts with these ends in view.

The next requirement is to appraise ripe stumpage at its existing market value. This is required by the act of June 4, 1897, which provides for the disposition of National Forest timber.

It has been urged frequently that the Government should attempt by the adoption of much lower stumpage rates to force large quantities of timber upon the market and reduce the price of manufactured lumber. The present policy can not be changed without a change in the law. No such change is called for. Sacrifice prices, unwarranted by actual market conditions, would reduce the returns to the public and to the States, but they would not reduce the price of manufactured lumber to the consumer. In the United States 99½ per cent of the timber cut comes from private lands. Competition in production is exceedingly keen. The mill capacity of the country is considerably greater than its normal consumption of lumber. This creates a constant tendency to produce more lumber than the market will take. During a period of depression actual overproduction appears. Stocks on hand mount up; price concessions to attract purchasers fail to bring the hoped-for acceleration of sales, and as returns fall below the cost of production curtailment is forced. From 1909 to 1911 many sawmills operated at an actual loss because carrying charges on their indebtedness would not permit them to close

down. One hundred and thirty mills in the two leading lumber-producing States were idle altogether. So long as competitive conditions obtain among manufacturers the lowering of National Forest stumpage rates would neither benefit the consumer nor appreciably affect the supply of lumber on the market. One-half of 1 per cent of the total cut is too small a fraction to have any influence on prices; and although this fraction might be made several times as great as it is by offering Government timber at a merely nominal charge, the effect would be simply to throw money away to procure the cutting of public timber in place of private.

That no return to the level of lumber prices that obtained 10 years or more ago, or lowering to a degree that would be felt by the consumer as a sensible relief against present prices, could be brought about by stumpage price concessions is obvious when the actual figures are borne in mind. The average price of the National Forest stumpage sold last year was \$2.10, but large quantities were sold for less than \$1, and some for as low as 50 cents per thousand. If the entire cost of the stumpage had in each case been subtracted from the retail price of the lumber, the consumer would have profited little. In actual practice, however, the remitted price would not have gone to the consumer. It would have gone as a bonus into the pocket of the stumpage purchaser, who would have sold at market prices. If timber unsalable at the stumpage prices now set by the Forest Service had been sold by offering it very cheap, but at the best prices obtainable, the bonus would have been paid to induce operations where the cost of production is relatively high, instead of on some of the private holdings now under exploitation. It is utterly absurd to suppose that, when the price of National Forest stumpage is so small a part of the value of the manufactured product, the retail price can be materially affected by decreasing the stumpage rate.

In short, the danger of excessive prices to the consumer as a result of timber monopoly is not a present but a future danger. It is not necessary to throw Government timber on the market as a protection to the consumer so long as the market remains open; and to do so under present conditions would be not only unnecessary but futile in immediate results, and seriously harmful for the future. By forced sales at reduced rates the Government would exhaust the public timber supply and thus throw away its most effective control of any future lumber monopoly. When private supplies of timber are largely exhausted and the production of lumber much more closely controlled, the National Forests will be of tremendous value in maintaining competitive conditions in the lumber industry. It would be folly to surrender this control of any future monopoly by attempting to force public stumpage upon the competitive market of the present time.

The requirements of the timber-sale policy as to prevention of speculation and monopoly are effectively met by the present methods of disposal. All large sales are widely advertised to promote competition among bidders. All contracts for periods exceeding five years provide for periodic readjustments of stumpage prices to meet changed market conditions. Holding stumpage for speculation

instead of manufacturing it is prevented by stipulations as to the rate at which cutting must proceed. New railroads constructed in connection with purchases are made available, under specific contract terms, to other purchasers from the Government. Under contracts approved during the year at least 160 miles of new railroad will be added to the common-carrier facilities of the National Forests. These roads will furnish an outlet for more timber. They will also open up the Forests, making possible more intensive use of all of their resources and aiding greatly in general industrial development.

The regulations against monopoly and speculation were materially strengthened during the year. Two conditions encountered not infrequently are the effort on the part of the same or allied commercial interests to acquire large amounts of public timber in successive sales, to the exclusion of other purchasers, and the effort of promoters or irresponsible parties with inadequate financial resources to secure large contracts as a means of speculation or as the chief asset in organizing stock companies. Successful bidders are now required to submit certified statements of the complete organization of the firm which is to carry out the contract, and of adequate financial resources to fulfill its obligations. These statements must be satisfactory to the Forest Service before the timber is awarded. A statement is also required of the affiliations of this company or its stockholders with any other companies holding contracts in the National Forests. If such statements indicate an interrelation of interests or control of large quantities of stumpage sufficient to constitute a monopoly, the bid is rejected.

Local demands are invariably given preference in the disposition of timber. On many Forests the entire yield is reserved for such needs. Small operators are preferred and encouraged as far as they are able and equipped to cut and market the stumpage. Large sales are restricted to inaccessible areas which small operators can not exploit, and to an amount sufficient only to justify the investment required. These are areas which can be logged only by extensive, well-equipped, and well-capitalized operations.

There has been a consistent increase in the use of National Forest timber for local industries and requirements of all kinds. This use is served mainly through small and medium-sized sales. It now requires about 12 per cent of the annual yield from the Forests. It will increase steadily. Free use is supplied to local settlers liberally under requirements which have been simplified to the farthest point consistent with reasonable protection of the public interests. Provision for sales at cost under the terms of the act of August 10, 1912, has been made, and it seems probable that farmers and homesteaders throughout the National Forest States will avail themselves generally of this privilege.

In connection with the classification and segregation of agricultural lands, the policy has been uniformly applied of selling the stumpage on lands which are heavily timbered but adapted to agriculture by soil and topography before listing them for entry. This course is necessary to prevent the acquisition of such lands by timber locators for speculative purposes, and to comply with the terms of the Forest homestead act, which requires that lands listed for entry thereunder shall be chiefly valuable for agriculture. The speedy

sale of timber on lands of agricultural value is sought by every means practicable in order that there may be the least possible delay in making such lands available for settlement. During the year approximately 10,344 acres of timbered land having agricultural soils were cut over and listed for entry under the terms of the Forest homestead act. Since the passage of the law 21,636 acres have thus been cleared and made available for settlement. The sales approved during the year contain approximately 24,557 acres of similar land which will be cut over and opened to entry in the near future.

To make the National Forests self-supporting and to cut their ripe timber for the double purpose of use and forest improvement requires a material increase in the annual sales business. This is being sought by every possible means consistent with the requirements and restrictions which have been set forth. That it is being accomplished is indicated by the substantial increase in cut over the preceding year and the great increase, exceeding \$2,800,000, in the amount of timber sold. The chief restrictions upon the ability of the Forest Service to sell ripe stumpage are the inaccessibility of three-fourths of the National Forest timber and the presence of much larger private holdings between the Forests and existing markets. Most of this private timber must pay interest on bond indebtedness and mill investments, aside from taxes and fire-protection cost. Such carrying charges force its rapid exploitation, with a consequent reduction in the possible demand for National Forest stumpage. These limitations, which are wholly beyond control, will affect sales from the Forests for a number of years.

The increasing volume of timber sales carries with it increasing administrative costs to estimate, appraise, and mark the timber, scale the logs as a basis for payment, supervise logging operations to enforce compliance with the terms of the contract, and dispose of the slashings. Special study has been given to the problem of reducing these costs. They are necessarily higher in small transactions, where the work is widely scattered and the Forest officer must move frequently from sale to sale, than in large. The average cost of administering small sales now ranges from \$0.45 to \$1.39 and of large from \$0.11 to \$0.39 per thousand board feet. It will not be possible to reduce these costs to any great extent further without rendering sale administration so lax as seriously to menace the interests of the public. How to meet the additional charge entailed in handling a steadily increasing cut is a serious question.

Many problems concerning the most effective utilization of National Forest timber are being studied. Such are the reduction of waste through closer manufacture and the production of distillates or other by-products, the extracting of naval stores as an accessory to lumbering, the use of inferior lumber species for the manufacture of paper, and the promotion of new or more valuable uses for particular species through preservative treatment. One of the most significant of the recent developments in National Forest sales is the demand for various western species for the manufacture of pulp and paper. The Forest Products Laboratory has demonstrated, through experimental runs of pulp and paper and tests of news print in actual use, that many western conifers are well adapted for the manufacture of news print and other standard grades of paper. These are particularly the red fir of California, the Engelmann spruce and

lodgepole pine of the Rocky Mountain and Northwestern States, and the Sitka spruce and western hemlock of the northern Pacific coast and Alaskan Forests. Four large sales of pulpwood are now pending—one in northwestern Montana, one in California, and two in Alaska. These involve the construction of pulp and paper plants, and if consummated will mark a significant expansion of the pulp and paper industry in the Western States. The Alaskan Forests particularly, with their enormous stands of excellent spruce and hemlock pulpwood, cheaply developed hydroelectric power, and direct tidewater transportation, offer excellent opportunities for the manufacture of news print.

Exceedingly valuable and practical results have also been obtained through demonstration of the desirability of telephone poles cut from lodgepole pine and treated with preservatives at the butt. The supply of western red cedar, hitherto the standard pole timber of the West, has become greatly diminished. In consequence, market prices are high, particularly in the Rocky Mountain region, where the cost of long freight hauls must be added to the first cost of the timber. It has been shown that lodgepole pine poles are stronger than cedar poles of the same dimensions and, with preservative treatment, considerably more durable. A substantial saving, both in first cost and in maintenance, can be effected by substituting lodgepole for cedar in many portions of the West. As a result of this demonstration, two sales of lodgepole for telephone and telegraph poles have been made. The enormous stands of lodgepole pine throughout the Rocky Mountain States, a timber of comparatively low cost and ideally adapted to use as poles by its prevailing size and form, are thus added to the available supply of pole timber.

THE SALES BUSINESS OF THE YEAR.

The sales business, by States, is set forth in the following table:

Timber sold and cut under sales on the National Forests.

State.	Timber sold.		Timber cut under sale.	
	Quantity.	Value.	Quantity.	Value.
	<i>Board feet.</i>		<i>Board feet.</i>	
Arizona.....	127,734,000	\$322,973.99	58,532,000	\$168,608.50
Arkansas.....	38,769,000	100,912.36	20,104,000	50,066.85
California.....	1,064,804,000	2,324,036.03	52,419,000	108,708.74
Colorado.....	60,273,000	126,767.84	42,446,000	86,548.81
Florida.....	30,000	15.00	40,000	18.00
Idaho.....	94,526,000	167,862.47	78,199,000	158,554.03
Michigan.....	276,000	263.57	130,000	180.00
Minnesota.....	205,000	990.00	57,000	228.00
Montana.....	179,697,000	404,709.97	82,757,000	185,036.77
Nevada.....	4,012,000	13,915.87	3,122,000	9,970.21
New Mexico.....	52,639,000	132,658.15	14,815,000	34,569.86
Oklahoma.....	13,000	59.30	13,000	59.30
Oregon.....	316,711,000	573,462.37	52,362,000	112,639.07
South Dakota.....	9,234,000	25,932.09	9,085,000	21,871.32
Utah.....	12,107,000	27,204.25	10,988,000	24,474.05
Washington.....	145,343,000	196,860.53	29,149,000	54,090.93
Wyoming.....	9,164,000	15,417.35	7,915,000	16,231.27
Alaska.....	21,774,000	31,017.71	33,535,000	43,327.14
Total 1913.....	2,137,311,000	4,465,958.85	495,668,000	1,075,184.96
Total 1912.....	799,416,000	1,600,773.55	431,492,000	942,819.21

The average value of the stumpage sold during the year was \$2.10 per thousand board feet, an increase of 10 cents as compared with the preceding fiscal year.

Proceeds from a large part of the timber sold will come in slowly on account of the necessity of constructing extensive improvements before cutting begins and the fact that the operations may extend over a term of years. In most large sales one or two years for preliminary construction are required.

The increased sales were partly in relatively small contracts for local use, but mainly in large contracts for the exploitation of inaccessible areas whose product will be marketed in the principal consuming regions of the United States. Twelve large contracts were approved for an aggregate total of 1,552,398,000 board feet. The most important of these was a sale of 800,000,000 feet on the Sierra National Forest, Cal., a transaction finally consummated after two years spent in estimates, stumpage appraisals, negotiations with the company, and advertising the timber. This sale well illustrates the policy pursued in developing inaccessible forest districts. Approximately 70 miles of railroad must be constructed into the interior of the Sierra Forest, together with a complete mill and logging plant. Twenty-two years are allowed for the removal of the stumpage, with provision for readjustment of the price at intervals of five years.

Sales under terms of similar character were approved for 182,000,000 feet on the Shasta National Forest and for 163,000,000 feet on the Umpqua National Forest. One of the most desirable of the larger sales during the year was that of 50,000,000 feet on the Crook National Forest, Ariz. The products of this sale will supply the Gila Valley and the extensive mining districts of southern Arizona, which hitherto has imported the greater part of its timber from the northern Pacific coast.

The most significant of the pending transactions are three proposed sales of pulpwood, two of which are in the Tongass National Forest, Alaska. The approved applications include also one for 153,000,000 feet on the Black Hills and Harney National Forests of South Dakota, whose products will be marketed chiefly in South Dakota and Nebraska. This sale will extend widely the local region supplied with lumber from the National Forests in the Black Hills.

The main causes of increase in timber sales were: The partial recovery of the lumber market from the depression of 1909-1911; the policy of making large sales under the conditions indicated, which has encouraged substantial companies whose own holdings are exhausted to seek new locations in National Forests; and the general stimulus to business on the Pacific coast and adjoining parts of the West, due to prospective markets to be made available by the Panama Canal. Additional causes of a more local character were the resumption of extensive construction by certain western railroads, with consequent demands for crossties, and the increased use of National Forest stumpage by mines and other local industries in various parts of the West.

First in demand is the white-pine timber of northern Idaho, now more and more widely used as a substitute for the depleted white-pine forests of the Lake States. Applications to purchase on the

National Forests of western Montana and northern Idaho are now far beyond the capacity of the Forest Service to handle with dispatch. Second only to this white pine is the demand for sugar pine in California and for western yellow pine in California and eastern Oregon and Washington. Both species furnish excellent building and finishing lumber, and both are being generally substituted for eastern white pine. The availability of many areas, by comparatively short hauls, to water transportation on the Pacific coast stimulates the demand for this National Forest stumpage in anticipation of marketing the product through the Panama Canal.

The demand for Douglas fir on the northern Pacific coast has been less active on account of the enormous amount of private stumpage under exploitation. A substantial increase, however, in western Oregon and Washington sales is taking place. The demand for western red cedar throughout the Northwest generally is very active, both for telephone and telegraph poles and for shingle stock. The limited supply of cedar-pole timber is giving this species great commercial value and resulting in many applications for National Forest stumpage at exceptionally high prices.

In addition to applications for large tracts of pulp timber in Alaska, the local use of timber on the Alaskan Forests has increased greatly during the past year. The greater part of this use is for box shooks and piling, but large quantities are cut for all forms of construction work. The Alaskan Forests now yield a revenue from local timber sales in excess of the cost of administration.

A steady and satisfactory sales business is maintained on the National Forests of Arizona and New Mexico in a number of medium-sized operations which cut railroad ties, lumber for the southern Missouri Valley, box shooks for the southern California fruit district, and timbers and rough lumber for local mines.

The Florida National Forest continues to support a considerable naval-stores industry. The receipts for cups placed during the year were \$14,447.52. The Forest is now being worked to the maximum capacity consistent with its conservative handling. Sales for supplying the varied hardwood-using industries on the Arkansas and Ozark National Forests are rapidly increasing and give promise of soon utilizing the entire yield. These industries include various forms of tight cooperage, furniture stock, and vehicle stock. In the central Rocky Mountain region the demand is strong for lodgepole pine railroad ties, mining stulls, coal props, and similar timbers. Several large Wyoming sales for crossties are pending. Lodgepole pine is admirably adapted to preservative treatment, and the vast lodgepole forests of the central Rocky Mountain region, midway between southern yellow pine and the Pacific coast fir, the two species now most widely used, should become a permanent tie supply center.

Following the removal by the last Congress of the embargo on exports outside the State of South Dakota of green timber from the Black Hills, the demand for timber from the South Dakota Forests has increased rapidly. This makes larger and better organized operations practicable. A considerable part of the cut will supply the large agricultural districts in South Dakota and Nebraska. Cutting on the Black Hills Forests for the local mining industry, local lumber supply, and railroad crossties was also active and will be materially increased during the ensuing year.

Small sales still form the great bulk of the transactions, indicating the continued local character of much of the business. As compared with 1912, the number of sales of a valuation of \$500 and less increased 6.26 per cent.

Number of timber sales, fiscal year 1913, classified according to amount of sale.

State.	Under \$100.	\$101 to \$500.	\$501 to \$1,000.	\$1,001 to \$5,000.	Over \$5,000.	Total number of sales.
Arizona.....	494	12	2	2	9	519
Arkansas.....	40	1	1	19	3	64
California.....	555	24	5	14	9	607
Colorado.....	747	33	14	22	5	821
Florida.....	3					3
Idaho.....	575	39	9	22	5	650
Michigan.....	10					10
Minnesota.....	4					5
Montana.....	1,215	51	18	36	13	1,333
Nevada.....	314	1	4	1		320
New Mexico.....	318	7	2	7	5	339
Oklahoma.....	• 14					14
Oregon.....	250	11	1	1	5	268
South Dakota.....	185	7	3	5	1	201
Utah.....	415	5	2	3	1	426
Washington.....	123	5	2	2	6	138
Wyoming.....	185	6	2	4		197
Alaska.....	249	7	7	4		267
Total 1913.....	5,696	209	73	142	62	6,182
Total 1912.....	5,179	378	78	92	45	5,772

The act of August 10, 1912, instructed the Secretary of Agriculture to sell at cost mature dead and down timber in National Forests to homestead settlers and farmers for domestic use. Regulations and instructions to carry out the terms of this statute were prepared and issued by the Secretary of Agriculture. Only the most essential restrictions required to prevent abuse of the privilege by persons regularly in the business of manufacturing lumber, having an ample supply of timber of their own, or who might endeavor to exchange material thus obtained from the National Forests for labor or other commodities in connection with its logging or otherwise have been imposed. During the short portion of the fiscal year when this statute and the regulations of the Secretary of Agriculture thereunder were in effect 91 sales were made, for a total of 718,000 board feet. It is probable that much more general advantage of this act will be taken by settlers and farmers in the vicinity of National Forests during the next year.

TIMBER TRESPASS.

The receipts for timber cut in trespass were \$14,207.55, as against \$40,238.22 during the preceding fiscal year. This reduction is gratifying, as indicating a marked reduction in amount of trespass upon National Forest lands. One hundred and forty-nine timber-trespass cases awaited settlement at the beginning of the year, and 82 new cases were reported during the year. Forty-five cases were referred to the Department of Justice for prosecution, 92 settled by the trespasser upon request, and 17 dismissed for lack of sufficient evidence or other reasons. At the conclusion of the fiscal year there were thus 77 pending cases.

TIMBER SETTLEMENT.

The receipts for timber cut in settlement cases during the year were \$35,123.27. These are cases where timber is cut in connection with the occupancy of rights of way or the construction of improvements as an incident to various commercial uses of the National Forests. The receipts from the same source during the preceding year were \$30,438.78.

FREE USE.

The following table indicates the free use of National Forest timber during the year:

Free-use permits, fiscal year 1913.

State.	Permits.	Grand total.	
		Quantity.	Value.
		<i>Board feet.</i>	
Arizona.....	1,735	4,459,000	\$11,391.44
Arkansas.....	83	187,000	466.67
California.....	3,118	8,918,000	18,011.15
Colorado.....	3,577	11,002,000	16,013.88
Florida.....	7	12,000	34.60
Idaho.....	6,277	21,405,000	32,351.13
Michigan.....	15	54,000	52.25
Minnesota.....	19	65,000	273.78
Montana.....	5,928	18,513,000	37,798.73
Nevada.....	511	2,638,000	4,281.43
New Mexico.....	4,390	14,611,000	21,067.71
North Dakota.....	128	42,000	51.10
Oklahoma.....	643	232,000	464.00
Oregon.....	2,820	12,049,000	17,551.22
South Dakota.....	1,147	5,080,000	5,814.39
Utah.....	5,549	12,026,000	13,656.79
Washington.....	583	2,611,000	3,478.36
Wyoming.....	1,734	7,750,000	8,970.49
Alaska.....		96,000	95.65
Total.....	38,264	121,750,000	191,824.77

Of the total amount cut, 33,179,000 board feet was live timber and 88,571,000 dead, with respective values of \$89,582.34 and \$102,241.77. Several changes in the regulations and instructions governing free use were made during the year, with the purpose of eliminating all avoidable delay and making the procedure more simple and direct. Only safeguards have been retained which are essential to protect the privilege from serious abuse or the Government from the creation of possible prescriptive rights which might embarrass future administration. The principal change was the granting of authority to district foresters to designate free-use areas containing dead timber from which, for a specified period, local residents, miners, and others entitled to the privilege may remove such timber as they desire for their own use without permit. Authority was also extended to local Forest officers to permit the removal of free-use material in other cases without measurement where it is believed that substantial compliance with the regulations will be secured and the convenience of the users facilitated.

PROTECTION.

LOSSES BY FOREST FIRES.—Losses by forest fires are reported by the calendar year, since the fiscal year closes in the midst of the fire season. The climatic conditions during 1912 were generally favorable

to fire protection, and with a steadily increasing efficiency of lookout and patrol the percentage of serious fires and the losses from them were greatly reduced. The timbered area burned over was 147,813 acres and the open 41,026 acres. The loss in timber destroyed or damaged was 16,480,000 board feet, with an estimated value of \$30,230; in reproduction, estimated at \$33,255; and in forage, at \$3,400. The total of \$66,885 was less than 19 per cent of the loss the previous year.

On private lands within the Forests 21,627 acres of timberland were burned over and 18,811 acres of open. The timber loss amounted to 8,579,000 board feet, valued at \$8,405, about 22 per cent of the loss on private lands in 1911. Expenditures for fire fighting were \$38,780.87, as against \$202,046.36 in 1911. This does not include time spent by regular Forest officers.

The timbered area burned over per 1,000 acres was 0.91 acre in 1912, as against 1.78 in 1911, and 19.90 acres in the disastrous 1910 fire season.

The following table shows the number of fires during the season of 1912 and their causes:

Forest fires during the season of 1912.

	Number.	Per cent.
Number of fires:		
Class A (under 0.25 acre).....	1,219	49.31
Class B (under 10 acres burned).....	657	26.58
Class C (10 acres or over).....	596	24.11
Total number of fires.....	2,472	100.00
Causes of fires:		
Lightning.....	676	27.35
Railroad locomotives.....	461	18.65
Campers.....	319	12.91
Incendiary.....	198	8.01
Brush burning.....	124	5.00
Sawmills and donkey engines.....	55	2.23
Unknown.....	505	20.43
Miscellaneous.....	134	5.42
Total.....	2,472	100.00

The steadily increasing use of the Forests brings with it a greatly increased population, both resident and transient. The total number reported as within the boundaries of the Forests during the year was as follows:

Resident population (settlers, etc.):

Principally lumbermen or millmen.....	5,510	
Principally stock raisers.....	8,305	
Principally miners.....	24,626	
Principally farmers.....	20,051	
Forest officers.....	1,330	
Other occupations.....	20,672	
Women, children, and dependents.....	113,512	
		194,006

Transient population:

In gainful occupations—

Logging: Driving, scaling, clearing, etc.....	42,151
Grazing: Herders, packers, etc.....	21,184
Prospecting, cruising, surveying, etc.....	17,447
Temporary Forest employees.....	3,961
Other occupations.....	32,434

117,177

Transient population—Continued.

Pleasure seekers—

Campers: Hunting, fishing, berry or nut picking, boating, bathing, climbing, etc.....	230, 827
Guests: At houses, hotels, sanitariums, etc.....	190, 859
Day visitors: Picnickers, wayfarers, etc.....	1, 055, 987
Other purposes.....	29, 835
	1, 507, 008
Total.....	1, 818, 191

The pleasure seekers are the greatest source of fire danger, while the settlers are the greatest protection, except where the theory of "light burning" has been advanced.

The efficiency of the Forest Service in fire discovery and fire fighting continues to increase, but the number of lookout men and patrolmen is still inadequate for the large areas of mountainous country to be protected.

The mileage of roads, trails, and telephone lines was largely added to. About 25 new lookout stations were established, with telephone connections, and improvements were made in various instruments for discovering and locating fires.

The fire plans made for various Forests, and revised in the light of experience, have made it possible to locate the areas of greatest fire hazard and to place fire-fighting equipments where they will be most accessible. Several thousand fire-tool boxes have been constructed, each containing axes, shovels, buckets, etc., and also first-aid materials for employees who may be injured. At some critical points caches have been made of staple provisions and emergency rations.

Further progress was made in the fire-protection cooperative agreements with States, railroads, timber owners, lumbermen, and other users of the National Forests. This cooperation is very important and offsets to a large extent the greater hazard which accompanies the rapidly increasing population of the Forests.

PROTECTION AGAINST POLLUTION OF STREAMS.—The watersheds of the National Forests protect streams which are used for municipal and domestic supply, for irrigation, and for power. It is fully recognized that the volume and proper regimen of the streams should be maintained, but it is quite as important that these streams should flow to their points of use unpolluted. Attention has already been called to the large and increasing population within the boundaries of National Forests. This population is rural or transient, and the absence of enforced sanitary regulations constitutes a grave danger in the spread of disease, particularly typhoid. Recreation use of the Forests means large numbers of campers, usually in close proximity to streams; and the numbers are greatest near cities. This danger has been fully appreciated and been made the subject of a special study, for the purpose of enforcing protective measures, so far as is possible with the authority and personnel of the service. Both are inadequate. It is possible to maintain sanitary buildings at ranger stations and properly dispose of sewage and refuse and to screen against flies, and thus by example as well as by precept to encourage other residents in these preventive measures. For several years Forest officers have been instructed regarding these matters, and numerous circulars and notices have been supplied for use at camping places. Agreements are made with lumbermen, stockmen, miners,

and other users of the Forests, by which they must take precautions against polluting the watersheds, but of course no compulsory measures can be maintained against persons living upon alienated lands. In some States, notably in Oregon, there is close cooperation with the State boards of health. It is expected that the study of watershed sanitation now being made will lead to recommendations regarding preventive measures against this menace.

PREVENTION OF INSECT DEPREDATIONS.—The problem of insect control on the National Forests is not unlike the problem of fire control. Small infestations may persist for a number of years without doing serious harm and then, under the right combination of conditions, spread rapidly and destroy enormous quantities of timber. In the aggregate, losses from this source have been serious on many of the areas now embraced within National Forests. A definite organization is called for to protect the public property from this injury, no less than to protect it against forest fires.

Insect control involves (1) reconnaissance, to locate and check incipient infestations, and (2) organized work on a large scale where serious depredations are in progress.

Under a cooperative arrangement with the Bureau of Entomology, which places the administrative handling of the insect-control work on the Forest Service, the work was organized in the three most heavily timbered districts. Extensive control operations were conducted on the Flathead and Deerlodge National Forests, in district 1, the Klamath in district 5, and the Okanogan in district 6. Control methods are developed by the Bureau of Entomology and in many cases are applied under the specific advice of experts of that bureau. During the year approximately 163,120 acres were covered. A great deal of reconnaissance to locate incipient infestations was conducted by the officers assigned to this work and the local Forest officers, and much was accomplished through destroying possible sources of future serious attacks. Control measures have now been applied to nearly all of the serious infestations previously located.

CONTROL OF FOREST-TREE DISEASES.—An important problem in the administration of the National Forests is the prevalence of various wood-destroying fungi which cause decay in merchantable timber and in the aggregate, if unchecked, greatly reduce the yield and value of timber. In developing more intensive methods of administration on the public Forests, it is important to know the life history and habits of these fungi and the workings of tree diseases, and to develop measures of control applicable in connection with the cutting of timber. Under a cooperative arrangement with the Division of Pathology in the Bureau of Plant Industry, three field experts of that bureau are continuously employed on the National Forests in studying this problem and devising means for ridding the Forests of diseases of commercial importance.

During the year a thorough study was made of the diseases of various species of oaks and the rate of deterioration of mature timber in the National Forests of Arkansas. The conclusions reached from this study, indicating that in spite of the prevalence of various forms of rot the deterioration of the white-oak timber in this region is very slow, have an important bearing upon the policy followed in timber sales. A study of the diseases of white fir and incense cedar in Cali-

fornia, both species peculiarly subject to defect from wood-destroying fungi, has led to the application of special requirements in timber sales for the removal of diseased trees, thereby ridding the forest of this menace. Freeing the forest of dangerous fungi to protect new growth from infection has become one of the objects uniformly sought in sale contracts. This is accomplished by felling diseased trees which may or may not have merchantable value, and by disposing of the slash in such a way as to prevent the breeding of such diseases.

REFORESTATION.

The importance of reforestation must not be lost sight of in the pressure for timber reconnaissance and sales, segregation of agricultural lands, and other urgent administrative work. At least 5,000,000 acres of denuded lands, capable of growing half a billion feet of timber annually, await artificial restocking. Further, the National Forests contain 1,175 watersheds which supply municipalities, 324 water-power projects, and 1,266 irrigation projects, aside from many other outside power and irrigation projects which are fed by watersheds within the Forests. The public consideration now being given to flood control, requests from many western cities for special measures to protect their municipal water supply, the concern expressed by irrigation associations in Colorado and elsewhere lest even the regulated cutting in the National Forests may reduce stream flow, and the rapid rate at which unused reservoir and power sites in the Forests are being developed evidence how important a function of the Forests is water protection. Reforestation is essential to the effective discharge of this function.

THE WORK OF THE YEAR.—The amounts of tree seed collected and purchased, and its average cost per pound, are shown in the following table:

Seed collected and purchased.

Source.	Conifers.		Hardwoods.	
	Clean seed.	Average cost per pound.	Clean seed.	Average cost per pound.
Collected by the Forest Service:	<i>Pounds.</i>		<i>Pounds.</i>	
District 1.....	8,117.75	\$0.49	8.75	\$1.32
District 2.....	17,891.13	.90	56.33	.20
District 3.....	334.00	1.01	94.00	.05
District 4.....	11,772.50	.82		
District 5.....	566.09	.87	150.00	.08
District 6.....	470.55	.51		
Total.....	39,152.02	.79	309.08	.12
Native species purchased.....	1,881.00	.73	28.00	.52
Exotic species purchased.....	81.00	.71		
Grand total.....	41,114.02	.78	337.08	.16

The exotic seed purchased consists chiefly of maritime pine for use in reforesting sandy barrens on the Florida National Forest and for experiments. The total cost of the 41,451 pounds of seed collected or purchased was \$32,232.38.

The reforestation work covered 29,446.02 acres, of which 23,777.73 acres were sown and 5,668.29 acres planted, at average costs per acre of \$4.04 and \$11.14, respectively. The total expenditures dur-

ing the year for seed, nursery stock, equipment, and labor were \$159,300.13. Douglas fir was used on over 10,000 acres, western yellow and western white pine on over 7,000 acres each, and lodgepole pine on over 2,000 acres, making over 92 per cent of the entire area; on the remainder a large number of other species were planted in small quantities. The work was distributed among the different States, as follows:

Sowing and planting, by States, fiscal year 1913.

State.	Area sown.	Area planted.	Total area reforested.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>
Arizona.....	186.00	35.85	221.85
Arkansas.....		13.33	13.33
California.....	133.16	276.77	409.93
Colorado.....	2,582.51	599.28	3,181.79
Florida.....	308.20	16.26	324.46
Idaho.....	9,399.00	1,389.86	10,788.86
Kansas.....		43.68	43.68
Michigan.....	17.14	89.35	106.49
Minnesota.....	11.40	55.00	66.40
Montana.....	218.50	1,076.08	1,294.58
Nebraska.....		311.20	311.20
Nevada.....	95.30	5.00	100.30
New Mexico.....		44.06	44.06
North Dakota.....		43.00	43.00
Oregon.....	5,574.95	646.60	6,221.55
South Dakota.....	1,627.50	5.00	1,632.50
Utah.....	1,494.15	769.82	2,263.97
Washington.....	1,813.06	248.00	2,061.06
Wyoming.....	316.86	.15	317.01
Total.....	23,777.73	5,668.29	29,446.02

Four-fifths of the nursery stock used was either western yellow pine, of which over 2,600,000 were planted, or Douglas fir, of which over 1,600,000 were planted. Austrian pine, jack pine, Engelmann spruce, and lodgepole, Scotch, and red pine were used in quantities ranging from 156,000 to 113,000 each. Hardwoods totaled 126,000 and all species 5,346,700.

The total capacity of the nurseries maintained on the National Forests was reduced somewhat to restrict the amount grown to what the field organization is able to plant with the funds available.

The present supply of nursery stock is as follows:

National forest nurseries and stock on hand.

Nursery.	Forest.	Seedlings.	Transplants.	Total.
Au Sable.....	Michigan.....	220,000		220,000
Boulder.....	Helena.....	2,803,000	1,322,500	4,125,500
Dakota.....	Dakota.....		32,000	32,000
Fort Bayard.....	Gila.....	120,260	109,500	229,760
Gallinas.....	Pecos.....	93,600	33,209	126,809
Garden City.....	Kansas.....	687,220	53,335	740,555
Halsey.....	Nebraska.....	4,112,200	1,618,000	5,730,200
Monument.....	Pike.....	1,411,600	1,112,000	2,523,600
Page Creek.....	Siskiyou.....	127,000	30,000	157,000
Pilgrim Creek.....	Shasta.....	86,000	252,000	338,000
Pocatello.....	Pocatello.....	2,707,100	30,500	2,737,600
Savenac.....	Lolo.....	1,612,000	5,161,000	6,773,000
Silverton.....	Snoqualmie.....	640,000	271,000	911,000
Trapper Creek.....	Bitterroot.....	260,000	202,000	462,000
Uinta.....	Uinta.....	1,963,000	344,500	2,307,500
Wasatch.....	Wasatch.....	3,640,500	259,500	3,900,000
Wind River.....	Columbia.....	1,897,000	1,826,590	3,723,590
21 ranger and other small nurseries.....		1,010,195	518,941	1,529,136
Total.....		23,390,675	13,176,575	36,567,250

The average cost of seedlings was \$2.95 per thousand, and of transplants \$4.96. In many of the nurseries costs have been substantially reduced.

FREE DISTRIBUTION OF PLANTING STOCK.—In accordance with the terms of the act of March 4, 1911, 189,000 young trees were shipped to settlers within the Kinkaid district, Nebraska, from the Halsey nursery. Approximately 350 trees were given to each of 540 settlers. As in the previous year, the distribution of nursery stock was restricted to persons who agreed to carry out the instructions of the Forest Service in regard to the care and planting of the material, and also to report subsequently on the success of the plantation. The stock consisted chiefly of western yellow pine, jack pine, and red pine, with a small amount of hardwood stock, particularly green ash and box elder. Young hardwood trees are in particular demand for ranch planting in this region and more stock of this character will be grown for future distribution.

Of the applicants who had previously received planting material, 51 per cent reported the condition of the trees at the end of the first season, showing reasonable success in 79.4 per cent of the cases reported. Many of the failures were due to delay in planting the stock after it was received and to other readily preventable causes.

RANGE MANAGEMENT.

The forage resources of the National Forests contribute in greater or less degree to the maintenance of over 20,000,000 head of domestic animals. The annual products of these animals amount in value to many millions of dollars and constitute a very large proportion of the meat supplies of the Nation. There is not a State in the Union whose demands for meats, hides, or wool are not met, in part at least, by the products of animals that have grazed upon National Forest lands.

With each succeeding year the western stock grower places an increasing degree of dependence upon the Forest ranges. The value of cultivated forage products has risen more rapidly than the price of meat. The unreserved public lands have been impaired in value by overstocking; their use for pasturage has been greatly complicated by increasing homestead settlement; their possibilities for the production of high-grade stock at moderate cost are poor, at least under existing conditions. Private grazing lands are in strong demand at prices undreamed of a few years ago. The National Forests furnish abundant supplies of forage, opportunity for the adoption of the most advanced methods of operation, freedom from epidemics fatal to live stock, and adequate protection in the enjoyment of all rights and privileges, all at a price from 50 to 75 per cent below the prevailing charges for comparable privileges on private or State lands. To the average citizen, concerned over the rapidly dwindling supply of meat products and the alarming rise in prices, the system of range management followed by the Forest Service offers greater hope of relief than any other single factor.

The value of the stock dependent upon the Forest feed is so great that a comparatively small improvement in general range conditions may readily result in the creation of tangible wealth sufficient to offset all costs of administration. In view of the increasingly important relation which the National Forests will bear to the production of

meat and animal products in the United States, it is imperatively necessary that every effort be made not only to utilize wisely but also to augment the stores of forage produced.

The system of range control devised and placed in operation by the Forest Service has won the approval of the overwhelming majority of the western stock growers by its simplicity, its common sense, and the larger profits which have followed its adoption. In its essentials it is seldom questioned or seriously criticized. The administration of the current grazing business presents comparatively few difficulties. The phases of the work which require careful technical observation and exact scientific data are not so far advanced. The Forest Service entered a new field when it first engaged in a detailed study of the multitudinous factors which influence the production and utilization of forage on over 100,000,000 acres of land, and it is still the pioneer in that field. This study involves an exact determination of the character and condition of all Forest lands and their products; the distribution and economic importance of all herbaceous plants and grasses which compose the vegetative cover of the Forest lands; the means by which the growth of economically valuable plants may be promoted upon denuded areas through natural or artificial methods of reseedling; the methods of handling live stock which will result in the highest degree of beneficial use and will minimize the present waste and destruction of forage resources; the extent to which regulated grazing will protect and promote Forest growth; and the character and extent of damage to Forests and watersheds which live stock may cause, together with means of minimizing or preventing such damage. Material progress has been made in all of these lines, but much remains to be accomplished.

GRAZING CAPACITY.

To the area under grazing administration were added during the year six tracts of land in the southern Appalachian and White Mountain regions, with a total area of 103,186 acres. While the grazing conditions are unlike those in the West, it appears quite certain that the principles of range management already worked out will apply satisfactorily. The lands have not been injured by overgrazing, and their continued use for pasture under proper regulation will not be inimical to the purposes for which the lands were acquired. The grazing rates charged are approximately equal to those paid when the land was in private ownership and somewhat higher than those made upon the National Forests of the West. This is fair and reasonable, considering the accessibility of the areas, their proximity to large markets, the higher cost of their administration, and the much greater proportionate investment of public money which they represent.

Although the gross areas of the National Forests were reduced by 789,728 acres, the number of stock grazed under permit was raised 4.09 per cent. The allowances for the grazing season of 1913 amounted to 1,852,999 cattle and horses, 8,521,306 sheep and goats, and 59,535 swine. As a result of increased forage production, better knowledge of the ranges, and improvements in handling stock, especially sheep, the carrying capacity of a large number of the Forests is slowly rising. Of equal importance is the fact that, owing to bet-

ter range management, the stock is being better distributed. Areas not formerly grazed are now occupied, relieving congested ranges. This benefits the range generally and gives better stock at the close of the season.

On some Forests protection from fires and overgrazing has caused dense timber reproduction to spread over areas heretofore available for stock. This loss in area, however, is more than made up by the use of other areas not heretofore fully utilized.

Both in California and elsewhere railroad development has brought about the substitution of shipping for trailing, with the result that former driveways over which passed more than 50,000 sheep each year are now opened for use by the regular permittees. In other places railroad extension has shortened the drives from ranges to shipping points.

RANGE CONDITIONS.

The season of 1912 was a very favorable one from the stockmen's point of view, although in the Northwest rather early snows in the fall forced the stock from the summer ranges somewhat earlier than usual. In Montana and parts of Wyoming bands of sheep were caught in the deep snow, but generally the stockmen were able to get their animals out without serious injury. Conditions during the previous summer had been so excellent throughout the entire West, with unusually heavy and well-distributed rains, that the winter ranges were in prime condition. The winter of 1912-13 was generally satisfactory, although in places the snow on the winter ranges was somewhat detrimental to the sheep. The spring of 1913 opened up very favorably and stockmen anticipated an excellent season. In southwestern Arizona the sheepmen who took their flocks to the desert ranges in the Salt River Valley had an unusually satisfactory lambing season and excellent feed for their flocks. As the spring progressed, however, unusually high, drying winds dried up the surface of the ground and made the spring feed throughout the West unusually late and of poor quality. On this account the spring lambing as a whole was not quite so satisfactory as was expected. For some unknown reason the increase in the calf crop also was below the average in parts of the Southwest.

EMERGENCY DEMANDS FOR RANGE.

During the season of 1912 parts of the State of California suffered severely from drought. Upon urgent requests arrangements to provide National Forest range for a considerable number of outside stock were under way when timely rains brought temporary relief to the stock growers. Continuance of the drought through the summer and fall of 1912 and the spring of 1913 increased the gravity of the situation, and appeals for relief were received from the stockmen, individually and collectively, and from the State legislature. A careful canvass showed that the Forests were, as a rule, stocked pretty close to the limit of safety, and in many instances the regular permittees protested strongly against the entry of additional stock. The only ranges available for sheep were those along the summit of the Sierra Nevadas, which have been closed to sheep grazing for many years

as a measure of watershed protection. In view of the critical conditions in parts of the State, it was deemed best to allow sheep to use the high ranges, for this season only. The stock growers within the region of drought were informed that within the State of California range would be provided for 42,000 sheep with their lambs, and for 8,000 cattle, while range to be used by stock en route to Missouri River markets could be provided in Colorado for 60,000 sheep and 15,000 cattle. The total number of stock affected by the drought was approximately 300,000 sheep, including lambs, and 25,000 cattle. The National Forest range thus made available was not fully utilized but helped materially to prevent heavy stock losses.

HIGH PRICES FOR STOCK.

In the fall of 1912 the stock left the various National Forests in the very best of condition. The prices for live stock, especially cattle, have never been so high in recent years as they have been for the past year, and the prices received for all classes of fat stock were record breaking. Weights were much above the average for past seasons, and still more above the average weight of stock of the same class grazed outside of the Forests. Cattle from the Hayden National Forest, in the State of Colorado, took the grand championship prize at the National Live Stock Show at Denver, and in many cases the lambs from the Forests topped the market.

IMPORTANT CHANGES IN LIVE-STOCK INDUSTRY.

In many parts of the West settlers who are building up herds of dairy stock are almost wholly dependent upon the National Forests. They are therefore agitating the question of separate ranges for milch stock, which in many cases can be provided. The development of the dairy industry in the National Forests will still further increase the value of the Forest resources.

Owing to the constantly decreasing open range on the unreserved Government lands there is a tendency among stockmen who are not using the National Forests to reduce their holdings and gradually withdraw from the open-range live-stock business. The conditions surrounding the use of National Forest ranges are, however, so permanent that stockmen who are permittees and using the Forest ranges during the spring, summer, and fall, depending on their farms for winter feed, are making very few changes. Comparatively few range stock outfits are sold whose owners are National Forest permittees. It is apparent that the Forest ranges are becoming more and more valuable each year, and that few permittees voluntarily relinquish their grazing preferences.

The unprecedented improvement in the prices received for beef animals has caused a reaction in favor of cattle and, except in district 1, the tendency among permittees during the past year has been largely toward changing from sheep to cattle. On the other hand, many of the large cattle outfits throughout the West have taken advantage of the present prosperous conditions to sell out their holdings and retire from business. This has opened more room for small owners and afforded an opportunity for a readjustment of ranges

which on various Forests has resulted in a vastly improved condition. The breeding stock has in some cases been purchased locally by small owners who have added it to their present holdings; in other cases by new Forest users.

ADVISORY BOARDS.

The Forest Service is at present cooperating with 115 officially recognized live-stock associations, of which two—the American National Live Stock Association and the National Wool Growers' Association—are national and one is a State association. New associations organized numbered 31. A new regulation which took effect May 1, 1913, gave a much broader scope to the field of cooperation with these associations, which may now adopt and request the enforcement of special rules designed to secure better management of the stock on the range. Such special rules when approved by the district forester will be enforced by the Forest Service, and will be binding upon all permittees using the range, whether members of the association or not. This method of cooperating with the stock associations will be of very material benefit. Hitherto improvements in methods of handling stock which were desired by the majority could rarely be put through, because the minority could not be required to contribute their share of the expense involved. Under the new regulation each person who enjoys a share of the benefits of a new improvement will have to contribute his proportionate part.

PERMITS.

The following table shows the number of permits issued and class of stock grazed, by States, during the fiscal year 1913:

Grazing permits issued and number of stock grazed under permit, fiscal year 1913.

State.	Cattle, horses, and hogs.				Sheep and goats.		
	Permits issued.	Number of stock grazed.			Permits issued.	Number of stock grazed.	
		Cattle.	Horses.	Hogs.		Sheep.	Goats.
Arizona.....	1,838	258,537	8,776	332	182	445,587	8,385
Arkansas.....	4	103					
California.....	2,664	169,951	11,705	2,360	377	435,856	13,249
Colorado.....	2,758	259,342	9,400		419	627,715	1,472
Florida.....	44	819		183	5	376	5
Idaho.....	1,509	100,385	8,401	125	728	1,714,569	
Kansas.....	77	14,830	293		1	250	
Montana.....	1,941	121,251	15,858		413	716,191	900
Nebraska.....	76	31,912	1,345				
Nevada.....	414	63,891	5,949		110	515,278	
New Mexico.....	1,791	98,612	5,362	196	595	417,685	52,857
North Dakota.....	9	270	175				
Oklahoma.....	41	4,230	348				
Oregon.....	1,509	92,872	10,395	81	561	885,229	30
South Dakota.....	432	7,228	2,215				
Utah.....	5,851	144,350	11,701		1,608	1,000,976	
Washington.....	266	9,924	852		126	220,789	
Wyoming.....	808	77,415	5,084		309	810,452	
Total.....	22,032	1,455,922	97,919	3,277	5,434	7,790,953	76,898

The number of cattle and horse permittees increased 3.98 per cent, the sheep and goat permittees 2.28 per cent, and the total number

of live stock grazed under paid permit 4.09 per cent over 1912. The increase amounted to 52,897 cattle, 2,576 horses, and 323,063 sheep, while swine were reduced by 1,027 head and goats by 6,951 head.

The cattle and horses averaged 70.5 per permit, as against 70.7 in 1912, and the sheep and goats 1,448, as against 1,421. The slight increase in the average number of sheep and goats is probably due to the pronounced tendency of small resident owners to change from that class of stock to cattle.

The total number of crossing permits issued during the year was 2,859, authorizing the passage of 64,790 cattle and horses and 5,153,484 sheep and goats. The stock occupy the Forests during periods of from 2 to 20 days and in many instances cross the Forest twice each season. The building of railroads over which sheep can be shipped to and from their ranges much cheaper than they can be driven materially reduced the number of stock driven over certain Forests.

USE OF PRIVATE LANDS.

Private lands within the National Forests are in strong demand for grazing purposes. The owner or lessee of such lands is protected indirectly from trespass or damage, and is afforded every opportunity to utilize his holdings or, by waiving the right of exclusive use to his land, to secure a free permit for the full number of stock his uninclosed land will support. There were issued 1,419 such permits, for 67,420 cattle and horses and 411,590 sheep and goats, in exchange for the release of 2,618,903 acres of private lands. This was an increase of 91,961 acres in area released and of 6,755 head in number of cattle and horses grazed, but a reduction of 63 in the number of permits and of 54,622 head in the number of sheep and goats grazed.

PROTECTION AGAINST DISEASE.

All quarantine regulations must be complied with before stock are admitted to the Forests. The use of black-leg vaccine, furnished free of charge by the Government, is becoming general. Carcasses of all animals dying of communicable or infectious diseases, such as anthrax or blackleg, must be burned or buried. As a result the National Forests are remarkably free from diseases dangerous to live stock, and the annual losses are much smaller than formerly.

Cooperation between the Forest Service and the Bureau of Animal Industry continued as in previous years. Inspections of sheep to determine freedom from scabies were required in New Mexico, Utah, parts of California, southern Colorado, and parts of southern Idaho. Two or three unimportant cases of cattle scabies reported from different Forests were effectively controlled. The outbreak of lip and leg disease in parts of district 1, which for a time threatened to become serious, is also under control.

Texas-fever ticks are found on only two National Forests, the Arkansas and the Ozark. The active work of tick eradication upon the Wichita Forest in Oklahoma and the Cleveland Forest in southern California has been brought to a close, although agents of the Bureau of Animal Industry will continue their observations on these Forests for a year or two to be certain that all danger of infection has passed.

The officers of the State of Montana solicited the cooperation of the Forest Service in the enforcement of the State law forbidding the use of tubercular cattle for dairy purposes. Persons who use the National Forests in Montana for the pasturage of dairy cattle must submit certificates of inspection showing the cattle to be free from tuberculosis, as required by State law, before they are allowed to place their stock upon the National Forests.

Just prior to the close of the year members of the Forest Service and the Public Health Service initiated some experiments in the use of sheep for eradicating the tick *Dermacentor venustus*, supposedly the chief agent in the spread of spotted fever. The sheep will not only feed out the areas where the ticks are most abundant, thus lessening the facilities for propagation, but will probably cause the death of large numbers of ticks which become entangled in their wool and subject to the action of the oils. The experiments were not initiated in time to secure any report of progress.

PROTECTION AGAINST WILD ANIMALS.

During the fiscal year 1913 the record kept covering the number of predatory animals killed upon the various National Forests by Forest officers showed the following results:

Predatory animals destroyed, fiscal years 1912 and 1913.

State.	Bears.		Coyotes.		Mountain lions.		Lynxes.		Wildcats.		Wolves.		Wolf pups.		Total.	
	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913	1912	1913
Arizona.....	22	34	196	112	62	69	3	-----	89	54	12	20	-----	24	384	313
California.....	12	6	478	337	3	3	2	2	160	132	2	-----	-----	-----	657	480
Colorado.....	18	21	824	483	3	-----	4	7	73	41	4	1	8	24	934	577
Idaho.....	35	49	1,010	551	7	2	3	4	82	41	21	5	20	-----	1,178	652
Kansas.....	-----	-----	2	4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	4
Montana.....	29	13	269	186	8	-----	18	11	11	12	27	5	36	-----	298	227
Nebraska.....	-----	-----	31	17	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31	17
Nevada.....	-----	-----	66	64	-----	-----	-----	-----	1	4	-----	-----	-----	-----	67	68
New Mexico....	9	6	94	34	21	3	30	22	26	* 6	33	8	13	-----	226	79
Oklahoma.....	-----	-----	38	35	-----	-----	-----	-----	32	25	-----	-----	-----	-----	70	60
Oregon.....	11	45	517	320	6	46	7	-----	53	92	18	10	11	8	623	521
South Dakota..	-----	-----	71	210	-----	-----	-----	4	12	30	2	9	-----	-----	85	253
Utah.....	19	3	671	749	3	3	5	-----	83	104	4	-----	19	-----	804	859
Washington....	20	16	9	18	3	7	2	1	7	7	-----	-----	-----	-----	41	49
Wyoming.....	3	13	502	421	-----	-----	11	11	7	35	6	6	53	41	582	527
Total.....	178	206	4,778	3,541	116	133	85	62	636	583	129	64	160	97	6,082	4,686

The numbers of predatory animals within the Forests grow less with each year and losses of live stock caused by predatory animals are of less frequency and importance than formerly, though such losses still constitute a heavy drain upon the stock industry. The employment of men for special assignment to the work of destroying noxious animals has, to a great extent, been discontinued, though a few men are still so employed, mainly in cooperation with stock growers' associations. The rise in the price of furs has attracted many professional trappers to the National Forests. The field officers will continue to kill large numbers of animals during the course of their regular work, to test formulas for poisoning baits, and to supervise the use by settlers within the Forests of traps and poisons furnished by the Forest Service. So far as can be foreseen

these provisions for holding the animals in check will prove fully effective at a very small additional expense to the Government.

PRAIRIE DOG EXTERMINATION.

The work of exterminating prairie dogs within the National Forests is now being handled entirely by the Biological Survey. So far as it has progressed it has produced excellent results and should not only be continued but extended. The fund available for this work should be large enough to enable the Biological Survey to complete the work upon any one Forest during one season. In this way the migration of the dogs into areas covered by previous operations can be prevented and the beneficial results obtained from the work be made permanent.

PROTECTION AGAINST POISONOUS PLANTS.

Investigations to determine means of reducing losses of live stock caused by poisonous plants were continued throughout the year by cooperation with the Bureau of Plant Industry, which has established a field station for experimental work near Greycliff, Mont., a part of the expenses being borne by the Forest Service. The principal plants studied were the larkspur, lupines, death camas, and rubber weed. It is quite apparent that a material part of the heavy loss sustained annually by the stock growers of the West through the presence of poisonous plants on their ranges is preventable and that the prevention of such losses is a big factor in securing increased meat production and lower costs of operation. Many species of plants are dangerous during only a small part of the season; so by determining the danger period and regulating the use of the area through fences, herding, or salting, it frequently is possible fully to utilize the feed on a poison area with little or no loss. This fact is receiving increasing recognition from the permittees and many of them are now fencing the poison spots on their ranges, the necessary timber being granted free of charge by the Forest Service. A noteworthy example of this kind of development is furnished by the Gallatin Forest, where over 30 miles of drift fence have been constructed to hold cattle off areas where in former years the losses of cattle were unusually severe.

GAME PRESERVATION.

During the year the field officers of the Forest Service assisted in the work of game preservation in a constructive as well as a protective way. A close study was made of the number and condition of the game animals and birds and of their habitats. The existing statutes were carefully analyzed to determine their influence in the protection and perpetuation of the different species, and many desirable changes in open seasons, bag limits, and methods of hunting were suggested to the proper State officers. The grazing of domestic live stock was regulated to afford protection to the breeding grounds and refuges of both animals and birds. Cooperation between the Forest Service and State game officers in the enforcement of State game laws was extended.

The National Forests contain the principal habitats of all the important game animals of the West, and the activities of the Forest officers contribute very largely to the protection of the game.

The Pryor Mountains preserve in the Beartooth Forest and the Sun River preserve in the Lewis and Clark Forest were created by the Legislature of the State of Montana during the year. The National Forests now contain a total of 10 State game preserves, 2 national game refuges, and a number of bird preserves surrounding reclamation projects. All of these areas are policed by Forest rangers in connection with their regular duties.

On the Grand Canyon game refuge the deer and birds native to the region have multiplied in such numbers that the success of the preserve is assured. The Wichita game refuge is one of the show places of Oklahoma, as the combination of rare game animals, forest cover, and unusual scenic beauty draws many visitors to the Forest. The buffalo herd now contains 48 animals, all thrifty and perfectly acclimated. Ten calves were born this year. Twelve elk were shipped from the Yellowstone National Park, increasing the elk herd to 24 head of grown elk, besides 3 calves born this year. An antelope fawn born last spring makes three antelope on the refuge. There has been a prolific increase in native deer and game birds, such as quail. The introduced wild turkeys have increased encouragingly, and the flock now numbers 28 birds.

During the year the Forest Service cooperated with the Biological Survey in the distribution of elk of the Jackson Hole and Yellowstone Park regions to suitable National Forests as follows: Colorado Forest, 23 head; Durango Forest, 23 head; Sopris Forest, 16 head; Sundance Forest, 21 head; and Wichita Forest, 12 head. The Sundance Forest already contained 21 head and their increase. In addition the Biological Survey placed 80 head of elk on the Sitgreaves Forest in cooperation with the State of Arizona, 25 head on the Wasatch Forest in cooperation with the State of Utah, and a number in the Billy Meadows pasture, Wallowa Forest, in cooperation with the State of Oregon. Other shipments were distributed by the States of Montana and Washington at points where the elk will undoubtedly find refuge in National Forests. The work has every appearance of success, and large increases in the nucleus herds may be anticipated. The areas upon which the elk were placed are not utilized by domestic stock, and the presence of the elk will not prove inimical to the interests of the stock growers.

Among the lines of work undertaken to make the Forests of more benefit to the general public is that of restocking streams, many of which have become depleted of fish. A great many requisitions for fish fry were favorably acted upon by the Bureau of Fisheries during the year, and the fry were planted by Forest officers, assisted in many instances by local organizations of public-spirited citizens. The success of earlier plantings leaves no doubt of the advantages of this work to the people using the Forests.

SPECIAL USES OF LAND.

USE FOR WATER-POWER DEVELOPMENT.

The development of water power upon the National Forests increased rapidly during the year, particularly in the State of California. The Sierra & San Francisco Power Co. had under construction a dam and reservoir on the Stanislaus National Forest to store additional water for a power plant covered by an earlier permit.

The San Joaquin Light & Power Co. completed a power house on the San Joaquin River and made additions to its storage reservoirs, all within the Sierra National Forest. Within the same Forest the Pacific Light & Power Corporation is engaged upon the construction of a series of four power projects to consist of two reservoirs, about 25 miles of cement-lined tunnels, four power houses, and a double steel-tower transmission line 240 miles long to Los Angeles. The power will be transmitted over this line at a tension of 150,000 volts—the highest yet attempted in commercial transmission. The ultimate development will be about 250,000 horsepower. On the Plumas National Forest the Great Western Power Co. has been engaged upon the construction of the Big Meadows Dam and Reservoir. This reservoir will have a surface area of 43 square miles, and will be one of the largest artificial lakes on the continent. A series of developments along the North Fork of the Feather River is proposed by this company, and preliminary permits have already been issued for power projects aggregating about 350,000 horsepower. One of the smaller plants on the Forest has already been constructed, as well as a plant of about 80,000-horsepower capacity just outside of the boundary.

The purpose of the administration of the water-power sites in the National Forests is to encourage power development in every way possible, while safeguarding the interests of the using public. In spite of the fact that the law unfortunately makes it impossible to grant a permit for a term of years, a great deal of development is going on under the present regulations, as the following statement shows:

Water power on the National Forests.

	Transmis- sion lines only.	Power projects (reservoirs, conduits, and power houses).	Estimated average output at minimum stream discharge.
Permits in force June 30, 1913:			<i>Horsepower.</i>
Rental permits—			
Preliminary.....		36	423, 200
Final.....	74	84	292, 100
Free permits.....	22	55	68, 300
Total.....	96	175	783, 600
Constructed or operating June 30, 1913:			
Rental permits.....	65	44	107, 000
Free permits.....	15	32	4, 200
Total.....	80	76	111, 200
Under construction June 30, 1913:			
Rental permits.....		21	121, 000
Free permits.....	3	8	1, 500
Total.....	3	29	122, 500
Construction not started June 30, 1913:			
Rental permits.....	9	55	487, 300
Free permits.....	4	15	62, 600
Total.....	13	70	549, 900
Applications received July 1, 1912–June 30, 1913:			
Rental permits—			
Preliminary.....		37	
Final.....	23	22	
Free permits.....	10	12	
Total.....	33	71	

Under the present regulations three forms of permit are issued. For small water-power plants for domestic purposes, irrigation use, mining, operation of sawmills, etc., in which the average annual use will not exceed 100 horsepower, free permits are granted and applicants are required to file maps and notes of survey sufficient only for proper location of the lands occupied and for the protection of the permittees against reapplication for the land by others. Where the power project is one of considerable size and more or less expensive investigations and surveys are necessary, a preliminary permit is issued. To secure this form of permit the applicant is required to present merely a sketch map of the proposed location and to file such information respecting water supply as he has readily available. The preliminary permit gives the holder priority as against subsequent applicants for the time necessary to make investigations and prepare the maps and plans required for final permits.

The regulations safeguard the interests of the public (1) by preventing speculative holding of power sites, (2) by providing for complete and prompt development and continuous operation, (3) by securing a return for the privilege granted, (4) by requiring permittees to abide by reasonable local regulations of rates and of service, (5) by providing a means through which the State or municipalities may acquire the properties of permittees situated on National Forest lands with the same facility and for the same purposes that such properties could be acquired if located wholly on private lands, (6) by prohibiting the capitalization of the value of the privileges conferred by the permit, and (7) in general by retaining the power to prevent unjust burden being placed on the consuming public.

The prevention of speculative holding of power sites is secured by requiring that construction of the works shall be begun and completed within a reasonable time and by requiring that permittees shall pay a small annual charge during the period preceding operation. When the works are constructed and operation begins, all prior payments are credited to the permittee against subsequent charges. By this means the public is protected against speculators who would otherwise hold power sites indefinitely without development, while the bona fide developer pays only the interest upon his deposits during the time of construction.

Applicants are required to file complete maps and plans of any proposed development. The maps and plans are then reviewed, and only if they show a reasonably complete development is a permit issued. The maps and plans as approved are made a part of the permit, and the works must be constructed in accordance with them.

The maximum rental charge is scarcely more than 0.01 cent per kilowatt hour of output, even in those cases where the entire development is upon the National Forests and the permittee generates only the minimum amount of power provided in the permit. On the average the charge per kilowatt hour is very much less than 0.01 cent, both on account of the deductions allowed when lands not in National Forests are occupied by the power plant, and because in many instances the site is actually developed far beyond the capacity upon which the charge is based. The total receipts for the year on plants having an aggregate capacity of 783,600 horsepower

were \$48,664.11, equal to 6.2 cents per horsepower per year, or 0.9 cent per thousand kilowatt hours.

The principle of local regulation of rates and of service is recognized by the requirement that all permittees shall abide by any reasonable regulations prescribed by State or local authority. A procedure is also provided by which a State or municipal corporation may acquire properties of permittees located upon National Forest lands in a manner similar to that followed in condemnation suits for properties located on private land. This is to prevent permittees from securing by the occupancy of National Forest lands immunities which they would not have were they located entirely upon private land. Permittees are protected, however, by the requirement that, in case the properties are taken over, the municipal corporation must pay the reasonable value not only of the properties situated on the National Forest, but of other properties outside the Forest which are necessary to make a complete operating unit and which therefore depend for their value upon the properties situated on the National Forest. It is further provided that in case of purchase the municipal corporation shall pay, in addition to the value of the works, a bonus which decreases according to the time the permit has been in effect. The bonus has been provided for the purpose of protecting permittees against dispossession of their properties before there has been opportunity to realize upon the investment.

One of the most important features of the regulations is the provision that neither the permit nor the occupancy of National Forests may be given a money value in any proceedings for the fixing of rates or for the sale of works built on the National Forests. Excessive profits in water-power development are obtained not so much in the form of returns upon capital actually invested as through the increase in values which follows the development. In a case recently brought before the Railroad Commission of the State of California a power company claimed \$14,000,000 valuation out of a total of \$20,000,000 for its Government permits, State water rights, and local franchises. Under a proper administration of an adequate law none of these items should be considered the property of the corporation, or should be a subject for capitalization in determining either price of service or value of operating property. As far as National Forest permits are concerned no such claim can be advanced.

OTHER SPECIAL USES.

At the close of the year 15,649 permits were in effect authorizing the occupancy of small areas of land for miscellaneous uses. These are principally either for purposes incidental to some other form of business use or to provide for recreation use of the Forests.

Of the first class are permits to stockmen for pastures, corrals, water tanks, dipping vats, etc., and to lumber operators for mill and camp sites. Of the second are permits for the construction of hotels, pleasure resorts, boathouses, etc., but most of all for cottage and permanent summer camp sites. Transient camps are, of course, pitched wherever the recreation seeker chooses to wander, without permits, restrictions, or formalities of any kind; but persons who

wish to use regularly the same piece of land and to construct some improvements for their greater comfort are assured exclusive possession of such land as they need through a special-use permit. The charge for such permits is nominal.

Recreation use of the Forests is growing very rapidly, especially on Forests near cities of considerable size. Hundreds of canyons and lake shores are now dotted with camps and cottages built on land use of which is obtained through permits of the Forest Service. This is a highly important form of use of the Forests by the public, and it is recognized and facilitated by adjusting commercial use of the Forests, when necessary, to the situation created by the needs of the recreation seekers. Examples of such adjustment are the exclusion of stock from localities where they would interfere with such a summer population, or the prohibition of use of certain canyons for driveways, and provision in timber sales for very light cutting, or no cutting at all, close to lakes and elsewhere where it is desirable to preserve the natural beauty of the location unmarred, for the enjoyment of the public.

A problem is raised by the fact that this important form of use is in danger of conflicting with an even higher public interest—the protection of the health of communities which use water from areas in demand for camping purposes. A responsibility to secure, if possible, adjustment of both forms of use in the interest of the largest net total of public benefit is recognized. To this end a system of sanitary regulation will be sought; full success, however, can be secured only if the Forest Service can join in close cooperation with cities and towns whose interests are involved. With such cooperation municipalities can be afforded much purer water supplies than it would ordinarily be possible for them to secure were the watersheds involved not within the National Forests.

The special-use permits include also large numbers which are issued to provide for all sorts of enterprises, such as small irrigating reservoirs, stores, livery stables, the cutting of wild hay, apiaries, and a multitude of others. These permits afford, in short, a means by which any Forest resource, no matter how minor, may be turned to individual account if its development does not conflict with some larger community interest. Thus the welfare of the population living in and near the Forests is promoted.

PERMANENT IMPROVEMENTS.

The construction of permanent improvements on the National Forests during the fiscal year was carried on with an appropriation of \$400,000, a reduction of \$100,000 from the amount provided for this use in 1912. Attention was concentrated especially upon the projects which pushed forward lines of communication into new territory. Necessarily the first care must be to provide the means of discovering, reaching, and extinguishing fires started by lightning and other causes in the most inaccessible and least protected parts of the Forests. There were built by the Forest Service 369 miles of road, an increase of 60 per cent over 1912; 285 miles of fire line, an increase of 30 per cent; 3,841 miles of telephone line, a decrease of 2 per cent; and 2,600 miles of trails, a decrease of 26 per cent. Other improve-

ments constructed were 79 bridges, 282 miles of fences, 81 corrals, 184 water improvements, and 491 houses, barns, and other buildings. The above figures include 254 miles of telephone lines, 231 miles of road, 177 miles of trails, 38 miles of fences, 16 bridges, 4 corrals, and 8 water-improvement projects built in cooperation with counties, associations, and individuals. The average amount contributed by the cooperators to such projects was approximately 60 per cent of the cost. Cooperation of this nature is a highly important adjunct to the ordinary Forest activities, not only because it contributes to the protection and development of Forests, but also because it brings the Forest administration into close and sympathetic relations, resulting from the community of interests, with settlers and users of the Forests.

The work done during the year brought the estimated present value of all improvements on the Forests, with due allowance for depreciation, up to \$3,380,102. Of this estimated value \$2,117,268 pertain to lines of communication and protection.

ROAD AND TRAIL BUILDING FOR THE PUBLIC.

To the road and trail building done as a part of the permanent improvement work proper, the purpose of which is primarily to equip the Forests with what is required for their protection, administration, and development, must be added that done under the provision of the appropriation act which makes available 10 per cent of the National Forest receipts for building roads and trails primarily for the benefit of the public. First consideration was given projects which would contribute (1) to the needs of settlers within the National Forests, and (2) to the needs of near-by settlers who are more or less dependent upon the National Forests. When in the selection of such projects a choice must be made between roads which form links in the main highway of a State and those which do not, preference was given to roads forming parts of State systems. Roads and trails which will primarily improve the National Forests and facilitate administration were given second consideration.

Since the law authorized the Secretary of Agriculture to secure the cooperation of the proper State or Territorial authorities in the furtherance of any system of highways of which the roads to be constructed within the National Forests form a part, the lists of projects as recommended by the district foresters were referred to the governors of the respective States for consideration. State officials have evinced a keen interest in these projects, which have also aroused much local interest.

SCHOOL, ROAD, AND TRAIL MONEY FOR STATES FROM RECEIPTS FUND.

Under existing law, besides the 10 per cent of the gross receipts which is made available for expenditure by the Secretary of Agriculture in building roads and trails for the benefit of the public, another 25 per cent of the gross receipts is paid over to the States by the Federal Government for the benefit of county schools and roads. The amounts available under both the 10 per cent and the 25 per cent clauses of the law during the fiscal year 1913, and the

amounts that will be available during the current year from the receipts of that fiscal year, are shown below:

Amounts available for States from Forest receipts.

State.	School and road moneys paid to States, fiscal year 1913.	School and road moneys payable to States, fiscal year 1914.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1913.	Road and trail moneys expendable by Secretary of Agriculture, fiscal year 1914.
Alaska.....		\$13,126.08	\$4,675.48	\$5,250.43
Arizona.....	\$61,651.02	74,659.49	24,645.77	29,868.80
Arkansas.....	5,708.81	12,854.02	2,283.52	5,141.61
California.....	62,052.82	74,541.55	24,321.13	29,816.62
Colorado.....	53,759.07	54,922.64	21,501.63	21,969.05
Florida.....	2,454.93	3,250.51	981.97	1,300.21
Idaho.....	59,523.79	78,163.90	23,809.52	31,265.56
Kansas.....	1,224.64	1,148.84	489.86	459.53
Michigan.....	5.78	65.43	2.31	26.17
Minnesota.....	1,258.19	201.63	503.27	80.65
Montana.....	59,816.37	65,238.15	23,926.55	26,095.26
Nebraska.....	4,075.89	3,098.59	1,630.36	1,239.43
Nevada.....	15,086.07	16,556.89	6,034.43	6,622.76
New Mexico.....	29,619.36	31,284.15	11,850.13	12,514.99
North Dakota.....	70.96	67.72	28.38	27.09
Oklahoma.....	878.45	673.20	351.38	269.28
Oregon.....	42,559.52	55,950.72	17,023.81	22,380.29
South Dakota.....	10,565.06	11,436.70	4,226.02	4,574.68
Utah.....	33,760.42	34,902.14	13,504.17	13,960.85
Washington.....	31,895.21	33,109.69	12,758.08	13,243.88
Wyoming.....	30,637.22	21,341.35	12,254.88	8,536.54
Total.....	506,603.58	586,593.39	207,304.65	234,638.68

The States of Arizona and New Mexico received additional shares of National Forest receipts for their school funds on account of school lands included within National Forests as follows: To Arizona, paid in the fiscal year 1913 from the receipts of 1912, \$27,737.71, and payable from the receipts of 1913, \$36,226.65; to New Mexico, paid in the fiscal year 1913 from the receipts of 1912, \$8,350.04, and payable from the receipts of 1913, \$9,320.65.

EXCHANGE OF LANDS. *

PRIVATE LANDS.

As National Forest timber cutting is extended a serious problem is not infrequently encountered in the presence of patented lands interspersed among Government holdings. This is particularly true in the case of checkerboard grants, where alternate sections are owned by the grantees or their transferees. The value of National Forest stumpage is frequently depreciated owing to the presence of these private holdings, and serious difficulties may be encountered in the construction of railroads or other means of development. The same reasons operate, on the other hand, to depreciate the value and render difficult the exploitation of the private lands in question. Hence, lumber companies and others generally desire to consolidate scattered holdings within the National Forests by an exchange with the Government, a transaction of obvious mutual advantage.

Precedents for such exchanges have been set by Congress in special acts authorizing them in the case of lands owned by the States of Kansas, Oregon, and Michigan. By act of July 25, 1912, Congress authorized an exchange with private owners within the Paulina

National Forest, Oreg. By act of August 22, 1912, a specific exchange with the Santa Barbara Tie and Pole Co. was authorized; in this instance Government stumpage on the Pecos National Forest was exchanged for the land and timber of this company on the Zuni National Forest, both in New Mexico.

Many exchanges of similar character are from time to time proposed, chiefly by companies which desire to exploit their holdings and find their scattered location intermingled with National Forest lands a serious handicap. Such consolidations of scattered land are nearly always as clearly to the advantage of the Government as of the private owners concerned, since the sale of timber will be facilitated. It is essential, however, that a uniform policy be adopted. In the first place, the benefit to the Government must be clear; exchanges should not be made merely for the convenience of the private owners involved. Secondly, the expense of necessary estimates and surveys should be borne by the private owners participating in the exchange. The advantages derived are sufficient to make this requirement reasonable, and the limited funds of the Forest Service for administration and protection should not be reduced to carry through such transactions. With these conditions exchanges are desirable, since the resulting consolidation of Federal holdings will greatly facilitate their administration and enhance the value of their resources. The principle embodied in the act of August 22, 1912, may well be applied to other cases of timbered land properly located for National Forest purposes and not adapted to agriculture.

STATE LANDS.

The examination of unsurveyed State school sections within the National Forests of Idaho, which was under way at the time of my last report, was completed. The examinations covered 548,157 acres. In lieu of these the State was authorized by presidential proclamation of March 3, 1913, to select 193,039 acres of timbered land from within the Kaniksu, Pend Oreille, and Payette National Forests. In lieu of the remaining 355,118 acres the State preferred to select an equivalent acreage from the public lands of the State outside the National Forests.

Under date of December 23, 1912, an agreement was entered into between the Department of Agriculture and the State of Montana for an exchange of lands within that State similar to the exchange in Idaho. Approximately 766,000 acres are involved. To meet the expense of examination by the Forest Service, a special item of \$25,000 was inserted in the last appropriation act. An equal appropriation has been made by the State legislature. A field organization has been perfected and the appraisal of the lands is now under way.

The act of Congress of July 31, 1912 (37 Stat., 241), authorizes the exchange of lands with the State of Michigan. It was not possible, however, to undertake any examination of lands under this act during the year, since the act carried no appropriation.

A bill has been introduced in Congress and approved by the department providing for the selection by the State of Oregon of a compact body of not to exceed 40,000 acres of timber land within the Santiam National Forest in lieu of unsurveyed school sections 16

and 36 scattered throughout the National Forests. The State desires to consolidate its holdings and administer the selected area as a forest in connection with the department of forestry of the Oregon State Agricultural College at Corvallis. In anticipation of the proposed exchange the Oregon Legislature has passed an act to withdraw from sale for a period of 50 years the lands to be acquired, and providing for the management of the forest by the State board of forestry. The act gives the State forest school certain privileges and duties thereon, regulates the disposal of the timber and other resources, and provides for the payment into the common-school fund of any revenue derived therefrom.

Negotiations are also under way for an exchange of lands with the State of Washington. An agreement is anticipated along the same general lines as the Idaho and Montana agreements. Any agreement entered into must be made contingent upon the appropriation by Congress of the necessary funds to carry it out.

ACQUISITION OF LANDS.

During the year the National Forest Reservation Commission approved for purchase tracts aggregating 425,717 acres, making a total of 713,415 acres. These lands are situated in 14 purchase areas within the Southern Appalachian and White Mountain regions. Twenty such areas have been designated, with a total area of over 6,600,000 acres, in the States of Maine, New Hampshire, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Tennessee, and Georgia. Full information concerning the work will be found in the reports of the National Forest Reservation Commission.

Purchases have not been made within six of the areas, because lands either have not been offered in sufficient acreage or the offered lands are not well enough grouped to warrant purchases. It is the aim to assemble within the purchase areas tracts of 25,000 acres and upwards, so that the lands acquired will be grouped favorably for protection and administration.

The basis for determining the prices to be paid and the desirability of purchase is secured by examinations made by the Forest Service. During the year the examinations covered 542,202 acres, bringing the total to 1,382,655 acres. As the work goes on the cost declines. More land is offered than the funds available will buy. At the end of the year 3,098,899 acres had been offered.

While it is impossible to utilize or fully to administer any land until title passes to the United States, provision has been made for the protection of lands against trespass and fire as soon as they are placed under purchase contract or as soon as condemnation proceedings have been filed. This has made it possible to do effective work at the start in protecting these lands, many of which have suffered severe damage from fires and trespass in the past. Forest officers have been placed in charge in those purchase areas where lands have been approved for purchase. These men not only look after the protection of lands which have been or are being acquired, but also oversee the examination and survey work.

The work of the Government in fire protection in these localities has greatly strengthened local sentiment against forest fires, and the more intelligent people are rapidly coming to the defense of the

forest against this unnecessary injury. It has also been possible, even in the short time which has elapsed since the titles to the first tracts were taken, to do considerable improvement work. Trails are the first need. During the year 250 miles of trail were built. Plans for the utilization of mature timber and other resources are being worked out. The bulk of the lands are in a cut-over or culled condition. In some cases the cutting has been complete, but generally the trees of inferior kind and quality have been left. The removal and utilization of these will leave the ground available for the production of a better crop of timber. Plans have similarly been made for the handling of the grazing business and for the utilization of the acquired lands under special permits.

COOPERATION WITH STATES.

Cooperation with States in protecting forested watersheds of navigable streams from fire, under section 2 of the act of March 1, 1911, was continued in accordance with the principles developed in 1911 and 1912 and discussed in former reports.

The original appropriation for this work, carried by the act of March 1, 1911, was \$200,000. Of this, \$93,464.65 remained unexpended on July 1, 1913. This balance was made available by the last Congress until June 30, 1915, and supplemented by a further appropriation of \$75,000 for the fiscal year 1914. Under the policy of restricting the annual expenditure in any State to \$10,000 and encouraging fire protection in as many different States as possible, the total yearly cost of this cooperation will not exceed \$100,000. Approximately \$85,000 will be allotted to the cooperating States at the beginning of the fire season. A contingent of \$15,000 will be retained to assist States in emergencies which require special measures and expenditures beyond those provided for in the plan of cooperation.

The following table shows the allotments and expenditures by States:

State.	Allotment, calendar year 1913.	Expenditures, fiscal year 1913.	Expenditures, Mar. 1, 1911, to July 1, 1913.
Maine.....	\$10,000	\$10,146.67	\$20,394.47
New Hampshire.....	8,000	9,729.00	16,909.40
Vermont.....	1,500	1,797.25	3,676.40
Massachusetts.....	2,500	2,552.00	3,742.00
Connecticut.....	1,500	846.75	1,353.25
New York.....	8,000	4,490.00	7,636.00
New Jersey.....	2,000	1,953.83	3,108.33
Maryland.....	2,000	1,076.50	1,486.50
Kentucky ¹	4,000	.....	.....
Wisconsin.....	5,000	4,644.50	9,733.25
Minnesota.....	10,000	7,990.75	24,076.25
Montana.....	3,500	27.50	27.50
Idaho.....	7,000	1,159.20	1,159.20
Washington.....	10,000	2,818.75	2,818.75
Oregon.....	10,000	7,414.50	10,414.05
Total.....	85,000	56,647.20	106,535.35

¹ No expenditures until fall of 1913.

During the year the cooperative field organization was extended to Idaho and Montana, on portions of the watersheds of the Snake and Missouri Rivers. An additional cooperative agreement, with the

State of Kentucky, has been practically completed; and agreements with the States of West Virginia and South Dakota are under consideration. Under the agreements in force a skeleton corps of 250 Federal patrolmen is maintained, which is increased as the fire hazard may require. This force guards an area of approximately 10,000,000 acres, for the most part mountainous and inaccessible, located on important watersheds and containing portions of the most valuable timber in the country. The patrolmen have maintained a high standard of efficiency, extinguishing hundreds of small fires and warning thousands of sportsmen, tourists, loggers, and others who frequent the woods against carelessness in the use of fire.

The original appropriation has been used conservatively, and its expenditure extended over nearly four years. The fund has been distributed among as many different States as can meet the requirements of the law. The expenditures of the State must in every instance equal those of the Federal Government, and in most cases the State expends several times the allotment received. Active co-operation on the part of private timberland owners and railroads has been encouraged by every possible means, and the amount of assistance from these sources is steadily increasing. All told, it is roughly estimated that for every dollar expended by the Federal Government for fire protection under the Weeks law, from \$3 to \$5 have been expended by the States together with private individuals and corporations.

The Federal expenditures are limited almost exclusively to the salaries of forest patrolmen and watchmen at mountain lookouts. These men are paid directly by the Government; no Federal funds are disbursed by the State.

The educational value of this cooperation has been shown by the impetus given to the enactment of legislation which would enable States to meet the requirements of the act. Since the passage of the law, Massachusetts, Connecticut, West Virginia, Kentucky, and Wisconsin have enacted legislation of this character; and bills making similar provisions have been introduced in the legislatures of North Carolina, Tennessee, Ohio, and California. An advantage to the States of no slight importance is the service rendered by the Federal Government as a clearing house for ideas on effective methods of State organization and fire control. A meeting of State foresters under the auspices of the Forest Service was held for this purpose in January, 1913, and much was accomplished toward standardizing fire protective organization, equipment, firebreaks, lookouts, and aids in the protective work of the respective States. In the inspection of field work a further opportunity is afforded Federal officers to suggest improvements and carry good ideas developed in one State to other States.

Cooperation in the protection of forested watersheds was initiated by the Weeks law as one means of assisting States in safeguarding the navigability of important rivers. At its inception this work was an experiment. The results of two and one-half years in actual protection and in educational benefits are conclusive as to its success. The function which the Forest Service is thus discharging bears a direct and important relation, not only to the preservation of navigability on important streams but also to the whole problem of flood

control. More than that, it is vitally related to the whole development of State forestry and fire protection and enables the Forest Service to assist effectively in the splendid progress along these lines now being made in many States.

Important assistance in shaping forest policies and drafting local legislation was extended upon request to New Hampshire, Rhode Island, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Missouri, Tennessee, Ohio, Michigan, Nebraska, California, and Porto Rico. The study of forest conditions in North Carolina in cooperation with the State Geological and Economic Survey, begun in 1910, was renewed. The work is practically a stock taking of the State's forest resources, special attention being given to devising less destructive methods of use. The report on forest conditions in Porto Rico, on which work was begun in 1911, was completed. Field data previously obtained in similar studies of forest conditions in Florida, Alabama, and Mississippi were also compiled.

NATIONAL FOREST INVESTIGATIONS.

To the seven forest experiment stations previously established was added the Wind River Station, in southwestern Washington, and the Converse Flat Station, in southern California, formerly conducted as nurseries. Reforestation problems continued to claim greatest attention, and a large number of experiments on the source of seed, seed extraction, nursery practice, and methods and seasons of sowing and planting were conducted. At the Wind River Nursery alone a series of 41 experiments was instituted to determine the best methods of nursery management, the proper amount of seed to sow, the best season of sowing, the proper cover for germinating seed, and the most effective methods of sowing and watering seed beds. The solution of these points will increase the quality and decrease the cost of the present yearly output of about 15,000,000 trees from the National Forest nurseries. Problems in field planting and sowing were also studied at the experiment stations and on important planting sites.

The ultimate success of the plantations now being established in large degree depends upon the character of the seed used. Studies were started of the effect of altitude, soil, age of species, density of stand, and other factors upon the character of seed of several species. The seed testing work in all districts was greatly improved in accuracy. Problems in the extraction of western yellow pine and lodgepole pine seed by artificial heat were thoroughly investigated. A number of improved mechanical devices have been perfected which materially cheapen the cost of extraction.

The most important investigations in reforestation seek to determine the relative cost and effectiveness of various methods of planting with different species and under varying site conditions. These consisted principally of tests with yellow pine, Douglas fir, lodgepole pine, and Engelmann spruce, in both direct seeding and the planting of nursery stock, covering a wide range of sites, and conducted at several seasons of the year. Seed was sown by means of corn planters in small cultivated spots, and by various methods of broadcasting on prepared and unprepared ground. The results have

gone far in defining the limits within which it is desirable to use each method in extensive operations.

Additional studies were begun in forest management. On several timber-sale areas special methods of marking, brush disposal, and systems of cutting have been kept under observation on sample plots. Intensive experiments on small areas, although slow, are most effective in determining the best methods of cutting to use on National Forests. The increased number of timber sales is greatly broadening the opportunity for such studies.

A study of the causes of failure and success of natural reproduction was made in the lodgepole-pine type on the Medicine Bow Forest. On the Leadville National Forest an experiment was made to determine the best methods of cutting in mixed stands of Engelmann spruce and alpine fir. Studies of the effect of different methods of cutting upon natural reproduction in the remaining stand were conducted during the year in district 1 with western larch, Douglas fir, western yellow pine, and lodgepole pine; in district 3 with yellow pine and shortleaf pine; in district 4 with aspen and yellow pine; in district 5 with sugar pine, yellow pine, and Douglas fir; in district 6 with yellow pine and Douglas fir; and with white and Norway pine in Minnesota.

A partial examination of thinning experiments begun in a lodgepole pine sapling stand on the Medicine Bow Forest in 1909 yielded data on the results of thinning on diameter and height growth and on the possibility of shortening the rotation. Other thinning experiments were undertaken in several districts in western white pine, western larch, Douglas fir, western yellow pine, Engelmann spruce, aspen, sugar pine, and incense cedar.

Mensuration studies during the year consisted principally in the collection of yield data for lodgepole pine on the Medicine Bow Forest and of volume data on yellow pine, lodgepole pine, and Engelmann spruce on a number of Forests. In district 3 volume data for western yellow pine were collected on approximately 5,000 trees on the Coconino and Tusayan Forests. Growth, volume, and yield of western yellow pine were studied during the year in all the districts. Lodgepole measurements were secured in districts 1 and 2, while growth, volume, and yield studies of Douglas fir were conducted in districts 1 and 6. Such data are of the greatest utility in reconnaissance and timber-sales work, and their collection will, as far as possible, keep pace with the extension of timber estimates on the National Forests.

The investigation at the Wagon Wheel Gap Experiment Station of the effects of forests on stream flow and erosion was continued. An additional experiment was inaugurated on an area near the original watersheds where the forest cover is more complete, the precipitation heavier, and the melting of snow in the spring much slower. On the Coconino National Forest, in Arizona, observations on the influence of forest cover upon the accumulation and melting of snow, run-off, and local climatic conditions, with special reference to silvicultural problems, were continued. Meteorological observations to determine the effect of climate upon the distribution of tree species were conducted at practically all forest experiment stations. They aim to establish exact factors which will furnish a key to the classi-

fication of forest types and a more accurate insight into the climatic requirements of various species.

In forage and range investigations the most notable event of the year was the establishment of the Utah Experiment Station on the Manti Forest, where all intensive experiments will be centralized. Ever since the Forest Service began its study of range problems it has been increasingly apparent that many of these problems required exact scientific study under controlled conditions which could be obtained only in a fully equipped experiment station. The Utah station was established primarily to handle range problems, but silvicultural problems also will receive attention, while studies of stream flow, run-off, and snowfall will be carried on in cooperation with the United States Weather Bureau.

Intensive reconnaissance by special parties of trained men was completed upon the Coconino, Minam, Medicine Bow, and Targhee Forests, with a total gross area of 3,331,000 acres, and is still in progress upon the Caribou, Manti, Tusayan, and Wallowa, with a total gross area of 4,391,000 acres.

In addition to the work by special parties, a great deal of range reconnaissance is being accomplished on different Forests by local officers.

Artificial reseeding studies included, in addition to the continuance of some experiments begun in former years, experiments at the Utah station with species of hardy Russian alfalfa to determine their adaptability to range use, and cultivation of both at the Utah and at the Fort Valley stations of promising native forage plants, to learn whether supplies of seeds could be produced at reasonable cost for reseeding purposes. Artificial reseeding, however, is becoming of less importance as the practicability of range regeneration through natural reseeding and rotated grazing is more fully demonstrated. It was shown on the Hayden, Bighorn, Manti, and Eldorado Forests that the vegetative cover can be greatly improved in this way. Through rotation the grasses and forage plants are allowed to reproduce on a portion of the range each year without loss of forage or food values, for after the seed has been scattered the area can be grazed. There are very few parts of the National Forests that can not be completely regenerated by the adoption of this simple and inexpensive system, provided the number of stock grazed is reduced to the normal capacity of the range.

Studies of the effect of grazing on yellow-pine lands were conducted on the Coconino, Payette, Shasta, and Uncompahgre Forests. Among the factors studied were the amount and severity of the damage from grazing by sheep, goats, and cattle for each tree species and in each locality, the time and character of the injury, the relation of intensity of injury to intensity of grazing, season of grazing, and method of handling stock, and the possibility of minimizing or eliminating damage by more careful management. A study of the effect of grazing upon erosion, stream flow, and purity of water supply was initiated upon the Manti Forest. These studies will extend over periods of several years.

To reduce interference with natural processes of reforestation, damage to tree growth and watersheds, depletion of grazing lands, and waste of valuable forest resources, it is important to develop im-

proved methods of managing different kinds of live stock on different types of forest land. The lambing of sheep in small inclosures on the open range was continued on the Cochetopa Forest, with results strongly confirming the successful findings of previous seasons. The relative merits of the new method of bedding sheep where they happen to be at nightfall or of returning them to an established bed ground a number of nights in succession were tested on the Bighorn, Lassen, Lewis and Clark, Madison, and Payette Forests. Although in some localities the sheepmen are somewhat opposed to the new method, its results are better sheep, less damage to the range, and more feed.

A band of sheep was grazed within the Beartooth Forest on range so remote from water that it has been thought unusable, with excellent results. If types of arid range can be used for sheep grazing a great deal of new range will become available.

Modern methods of management require the confinement of stock to relatively restricted ranges and the substitution of fences for mounted men. The National Forests now contain thousands of miles of drift, division, and pasture fence. Systematic study of the adaptability of different types of fence to different conditions of range use, of their relative efficiency for different kinds of stock and ability to withstand snow pressure, and similar matters, of details of construction such as materials, spacing, and bracing, is in progress. In many of the Forests advanced methods of range management or the full and economical use of forage can not be applied until the present water supply is augmented. Study of the almost 700 projects completed by the Forest Service and its permittees secured information which will facilitate future water development by bringing out the methods which have proved most successful and economical in improving existing supplies and developing new ones in different localities.

An appreciable percentage of National Forest land is not occupied by any domestic live stock, although a considerable amount of the unused range contains valuable supplies of forage which should be used. The principal reasons for nonuse are: Inaccessibility, shortage of water, occurrence of poisonous plants, and the presence of large numbers of predatory animals. A general study has been initiated to determine the acreage and distribution of all Forest land not used for grazing purposes; how much of it might be grazed; what prevents its use; and what development work would bring about full utilization. As information is acquired steps will be taken to make the land available for the use of stock growers. This work should materially enlarge the productive capacity of the Forests.

OTHER INVESTIGATIONS.

SILVICULTURAL AND DENDROLOGICAL STUDIES.

Studies of important commercial trees of the United States, covering their growth, volume, yield, utilization, life history, and management, were completed during the year for western hemlock, western white pine, sugar pine, incense cedar, jack pine, lodgepole pine, and red pine in the West, and hemlock, shortleaf pine, and red spruce in the East. Studies of western white pine, western larch, California red fir, and Douglas fir in the West, and of bald cypress,

willows, and northern hardwoods in the East, were begun. In connection with the tree studies 33,000 forest measurements were gathered. These were worked up into 70 volume, 13 yield, 16 form, 23 growth, and 6 miscellaneous tables, 1,258 copies of which were distributed in answer to inquiries from lumbermen, timberland owners, and foresters.

Substantial progress was made in the establishment of an arboretum in Rock Creek National Park in cooperation with the District of Columbia. Seven acres have been planted with 70 species, mostly conifers, in good-sized groups to bring out forest as well as botanical characteristics.

Approximately 20,000 basket-willow cuttings were distributed to the agricultural experiment stations, 15,000 to forest schools, and 81,000 to individuals in practically every State. Cooperation in basket-willow culture with the Iowa State Agriculture College, at Ames, and with the State forester of New Jersey was continued. Studies of the botanical and commercial range of important North American trees furnished data, compiled in the form of maps, on 13 of the pines, 21 ashes, and 8 other species. Three thousand new range points were added to the records. An economic and taxonomic study of the shrubs of the genus *Ceanothus* was begun during the year. This genus is an important forage plant, and also has a bearing on the reforestation work on burned-over areas, of which it often takes possession. A check list of the trees and shrubs occurring on the National Forests is in preparation.

Studies of wood structure included ashes, hickories, firs, maples, and birches. Among the exotic woods whose structure was studied were *prima vera*, *cocobola*, cam wood, and bar wood.

Cooperation with private owners was confined to examinations of small tracts of woodland in States which have no organization for forestry work. Nine examinations were made of privately owned woodland, covering nearly 33,416 acres. The Forest Service now has an agreement with 26 States, under which applications for examinations of private woodlands are referred to the State organization. A series of publications summarizing the data obtained by the Forest Service on forest management, reforestation, and utilization by regions, and adapted principally to small owners, is in preparation.

STUDIES OF FOREST PRODUCTS.

UTILIZATION OF NATIONAL FOREST TIMBER.

In connection with the marketing of National Forest timber, studies were made during the year of the box industry in the Northwest, the various industries producing articles from western red cedar, and the pulp and paper industry on the northern Pacific coast. A study of yields in naval stores from western yellow pine and other conifers on the National Forests was continued. Intensive studies of the cost of manufacturing lumber in various types of mills were completed in Oregon and Washington, and were supplemented by mill studies of the amount and grade of lumber yielded by different classes of Douglas fir and yellow-pine logs. Other studies looking to the fullest

utilization of National Forest timber were made of the preservative treatment of railroad ties, fence posts, and telephone poles, in cooperation with various commercial interests, and of methods of kiln-drying certain kinds of lumber difficult to season. Many market and other special problems were investigated in connection with individual timber sales, for the information and guidance of administrative officers.

WOOD PRESERVATION.

Experiments were made during the year in connection with wood paving blocks, the principal objects being to determine whether tar in creosote retards the penetration of the oil into the wood, and the connection of such adulteration with the disadvantages of this type of pavement. Experiments were also carried on in the preservation of timbers used in silo construction, with very good results. Tests were continued on the efficiency of various preservatives, 30 different ones having been tested up to the present time. Experiments were made with various fractions of creosote in protecting southern yellow-pine piling on the Gulf coast from marine borers, with the aim of reducing the great damage done by these very destructive agents. Investigation was also made of the relative inflammability of woods, a subject of great importance to users of construction timbers. All of the more important conifers have now been tested for their relative inflammability, and experiments have been begun with various fire retardents for rendering the wood practically incombustible.

WOOD CHEMISTRY AND DISTILLATION.

Distinct progress was made during the year in the investigation of the production of ethyl alcohol from wood waste, though the optimum conditions for producing alcohol have not yet been determined. Through arrangements with a turpentine company in Michigan, a commercial test was made of Douglas fir to determine its suitability for the production of turpentine and rosin. Tests to determine the distillation yields of various species of hardwoods were continued. Results already secured in this study have made it possible for at least one hardwood lumber company to utilize crooked logs, tops, and slabs heretofore wasted, and so double the amount of timber used from the same acreage.

TIMBER PHYSICS.

Excellent results were obtained with the experimental kiln at the Forest Products Laboratory in drying special vehicle stock of high commercial value. Continuation of the experiments in kiln drying eucalyptus lumber in California also gave important results.

TIMBER TESTS.

Further work was done during the year in studying the mechanical properties of woods grown in the United States. About 4,000 tests were made at the Forest Products Laboratory each month. A final monograph concerning the results of the whole investigation is now being prepared.

PULP AND PAPER INVESTIGATIONS.

Studies to determine the effect of the various cooking conditions on the yield and quality of fiber by the soda and sulphate processes of paper manufacture were continued. Longleaf pine was the wood used in the tests by the sulphate process and aspen in the soda process. Experiments in grinding wood pulp at the Wausau Laboratory afforded important data concerning variations in yield and quality of paper due to differences in power used, pressure upon the stones, and sharpness of the stones. In addition, a number of species, heretofore unused, were shown to have commercial value for the manufacture of news print.

The work outlined for the ground pulp laboratory at the time of its construction has now been largely completed. The fundamental laws of grinding pulp have been established with sufficient accuracy for all practical purposes, and tests have shown the commercial possibilities of nearly all American species of wood of any possible importance to the news-print industry.

INDUSTRIAL INVESTIGATIONS.

In cooperation with the Bureau of Plant Industry and State officials a study was begun during the year of the means of utilizing chestnut timber killed by the blight disease. Investigations were made in Connecticut, Maryland, and New York to determine the rate at which blight-killed timber loses commercial value. Information was also gathered concerning markets in the infected regions for chestnut products.

During the year work was begun on a comprehensive study of prevailing specifications for both rough and manufactured lumber. Data was also obtained concerning the form and size of pulpwood required at most of the manufacturing plants in the United States.

To secure the acceptance of grades of wood against which an unfounded prejudice exists, a study was made of the prevailing specifications for tool handles, with particular reference to the requirements of certain departments of the Federal Government.

As in previous years, statistics showing the production and consumption of lumber, lath, and shingles, crossties, pulpwood, veneer stock, cooperage, excelsior, poles, and wood used in distillation were obtained in cooperation with the Bureau of the Census. On account of the cost, annual figures have been discontinued, except in the case of lumber, lath, and shingles. Statistics of other products will be obtained every five years.

Wood-using industry studies, each showing the kinds and amounts of woods required by the various industries, the purposes for which the different species are employed, and the extent of their use, were continued. Up to the present the work has been completed for 20 States.

MISCELLANEOUS.

Forty-six new publications were issued and revisions of three old ones. In all, 337,765 Forest Service publications were distributed. There were added to the library 990 books and pamphlets, bringing the total number of volumes up to 17,007, and to the libraries main-

tained in the District and supervisors' offices, the Forest Products Laboratory, and the Office of Forest Products, at Chicago, 3,689 books and pamphlets, bringing the total number of volumes in these libraries up to 24,516.

Members of the Forest Service delivered 149 public addresses, mainly in response to requests from educational institutions, associations of lumbermen, lumber manufacturers, and users of the National Forests.

Exhibits, consisting of bromide enlargements, transparencies, maps, models, and charts, were made at the National Corn Exposition, Columbia, S. C.; the United States Land Show, Chicago, Ill.; Seventh Dry-Farming Products Exposition, Lethbridge, Canada; Forestry Exhibition, Philadelphia, Pa.; State Fair, Rockingham, N. H.; and State Fair, Salem, Oreg. One of these exhibits was supplemented by explanatory lectures. All expense for transportation and installation of material and for travel and subsistence involved in making the exhibits was borne by the exposition authorities.

REPORT OF THE CHEMIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF CHEMISTRY,
Washington, D. C., November 24, 1913.

SIR: I have the honor to submit herewith a brief report on the work of the Bureau of Chemistry during the fiscal year ended June 30, 1913.

Very respectfully,

CARL L. ALSBERG,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

The work of the Bureau of Chemistry may be said to be divided into three groups:

(a) *Regulatory.*—The enforcement of the food and drugs act, which is designed to prevent the interstate shipment of foods and drugs which are unwholesome, or adulterated, or offered for sale under misleading labels. The Bureau of Chemistry gives assistance to the Insecticide and Fungicide Board by making analyses, holding hearings, and collecting samples.

(b) *Standardizing.*—The preparation of specifications for purchasing supplies, under contract, by the United States Government, and testing to see that supplies furnished are in accordance with the specifications.

(c) *Investigational.*—This work is of two types; the first serves more purely regulatory purposes and includes such investigations as the search for new forms of sophistication, the development of methods for the detection of adulteration, and the discovery of the cause and source of contamination in foods. The second type consists of constructive work looking to the development of new uses, sources, and methods of preparation of foods and drugs with reference to the conservation of the food supply, the prevention of waste, and the utilization of waste by-products. This type of work includes necessary investigations in analytical, agricultural, and biological chemistry. The two types of investigation merge into each other. An investigation undertaken solely for regulatory purposes often discloses facts which lead to constructive work of great importance and vice versa.

REGULATORY.

SHERLEY ACT.—The work of the Bureau of Chemistry under the food and drugs act during the year was greatly stimulated by two important acts of Congress amending this law. The first, known as the Sherley amendment, enacted August 23, 1912, deals with medicines branded with false and fraudulent statements concerning their effect on disease. To make this act rapidly effective, as many chemists as could be spared were transferred during the winter from food to drug work. These chemists, transferred to the laboratories in Washington, New York, and Chicago, in a few months analyzed hundreds of these preparations. As a result of this work seizure of several of these preparations was recommended and the resulting cases were won by default. Even at this early date a vast improvement in the labeling of medicinal preparations has resulted. Such positive therapeutic claims as "a sure cure," "a reliable remedy," and the like are being replaced on the labels by less misleading expressions, such as "will be found beneficial in" or "will relieve many of the symptoms of." Claims that preparations are cures for such serious diseases as tuberculosis or cancer do not appear on the labels as often as formerly.

Through the Secretary of the Treasury it has been possible to apply the Sherley Act to nearly all importations of drugs, so that false and fraudulent labels should soon disappear from imported medicinal products.

NET-WEIGHT ACT.—The second amendment, the net-weight act, enacted March 3, 1913, requires that all packages shipped in interstate commerce shall be plainly and conspicuously marked to show the quantity of the contents. Although this act went into effect immediately, it provides that no penalties shall be imposed for 18 months from the date of the enactment. The equitable enforcement of this act, apparently so simple, is actually very complex. Shrinkage, variations of containers, and errors in weighing, measuring, and counting by hand or by machinery must be studied for a vast variety of products. The gathering of this information devolves upon the Bureau of Chemistry. Many of the investigations show that manufacturers endeavor to furnish full-weight products, but that there are practical difficulties which cause variations in the weight of individual packages. Moreover, for the study of shrinkage, experimental shipments of a large variety of goods to various points in different climates are being made to detect changes in weight and bulk due to variations in temperature and humidity. At the same time the normal water content of foods is being investigated, a most important matter if the law is to be enforced intelligently. Though a vast amount of material is being accumulated in this way, it will be some years before all the necessary facts have been ascertained for all products.

INSPECTION.—The number of inspectors has been increased from 41 to 44. They have collected approximately 10,000 samples for examination, in addition to many other samples secured for information, and have visited several thousand manufacturing establishments to note violations.

A general policy of concentration has been inaugurated to insure greater efficiency. The inspectors have been grouped in the larger

centers, as far as practicable, and now cover their territory by traveling from these centers. As a result the work is more effectively systematized and the necessary clerical work can be done by clerks, so that the inspectors are free to spend nearly all of their time in the field. Thus the stations at Houston, Tex., and Oklahoma City, Okla., were abandoned and new headquarters for that section created at Dallas, Tex.

BRANCH LABORATORIES.—There are now 21 branch laboratories since, in accordance with the policy of concentration, the one at Galveston, Tex., has recently been closed. The Territorial legislature is contributing to the support of the laboratory at Hawaii. The work of these laboratories is mainly to hold hearings for manufacturers in their territory who have been cited under the act, to examine samples assigned to them, and, when called upon, to assist the local district attorney. Often they are directed to gather technical information concerning some industry in their territory. This year they have made extensive investigations, necessitated by the enactment of the net-weight act.

Special mention should be made of certain parts of the regulatory work.

MILK.—During the past winter and spring special attention has been paid to the milk in the small towns, which frequently have insufficient, if any, milk-inspection service. The small towns adjacent to the great cities have become the object of careful inspection, for in such places milk which can not pass the city inspection is often placed on sale. Formerly it was the policy to take one sample of a shipper's milk and if the bacterial count was very high to recommend prosecution. This sometimes resulted in injustice and frequently caused the producer to cease shipping, as he did not know how to improve the quality of his milk. The present policy is to examine a series of samples, to cooperate with the Dairy Division of the Bureau of Animal Industry in teaching cleanliness to producers of milk, and to prosecute, finally, if the producer fails to follow suggestions. This has resulted in a notable improvement without seriously curtailing milk production.

SHELLFISH.—The water and bacteriological laboratories cooperated in a study of the character of the water of the Potomac River and of the Maurice River, N. J., to determine to what degree these waters were polluted and the effect of such pollution on the shellfish obtained from these rivers. The investigation of the Potomac River was made with the active assistance and cooperation of the Maryland and Virginia State Boards of Health. This work has been completed. Further, the shellfish have been examined regularly, particularly those from waters believed to have been contaminated from sewage.

FLOUR AND FEED.—A comparison of the chemical composition of natural flour and flour bleached with chlorin has shown that the chlorin bleaching lowers the iodine number of the fat and introduces into the fat, which in natural flour contains hardly a trace of chlorin, a determinable amount of this element. This fact has been utilized in an analytical method for detecting a chlorin-bleached flour.

Investigations into the milling industry showed that it was a general practice to add screenings and mill refuse to mill by-products feeds during their manufacture. Many illegal shipments were seized. The adulteration of feed barley with weed seeds, hulls, screenings, or worthless material for the purpose of raising the weight before shipping consignments to ports on the Atlantic coast for exportation has been stopped.

OLIVE OIL.—During the last six months of the fiscal year the source and quality of a large number of samples of olive oil have been investigated. As a result of this examination it is believed that in some instances olive oil is intentionally misbranded by the shippers. The fine distinction between various grades of olive oil dependent on the places of production, which, as in the case of wines, is of much importance to the trade where it is determinable by the senses, has not been taken up by the department.

MALT BEVERAGES, WINES, AND DISTILLED LIQUORS.—Certain beverages are labeled as made solely from hops and malt when, as a matter of fact, they are made from malt mixed with grains. Seizures were made of these misbranded products. The facts obtained in an extensive investigation of the composition of beverages brewed under known conditions made this regulatory work possible. Certain wine manufacturers in Ohio shipped quantities of fictitious wines branded as if made from a particular variety of grapes grown in another State. Several shipments of this product were seized.

Spurious brandy under misleading labels has for years been imported. Its importation has been stopped.

Vodka, a potable spirit manufactured from potatoes or grain by a Russian Government monopoly, was found to be imitated very closely in containers and labels by various firms in New York City and Brooklyn. The liquor in these packages was found to be ordinary ethyl alcohol diluted. This led to the seizure and confiscation of many such illegal shipments and to the assessment of court fines against the manufacturers.

CANNED FOODS.—A most comprehensive investigation of the canning industry was conducted by the Bureau of Chemistry during the late summer and fall months of 1912. Effects of inspections made for several years past were apparent in the improved sanitary conditions of the factories, cleanliness of help, character of raw materials used, and their treatment. Since the issuance of Food Inspection Decision 144 most packers are raising the standards of their goods by eliminating various added diluents.

From August to October, 1913, a representative of the Bureau of Chemistry visited Italy and studied the manufacture of Italian tomato sauce and tomato paste, large quantities of which are annually imported into the United States. This study was made primarily to learn conditions of manufacture, particularly in regard to sanitation, as a guide for the examination of products offered for importation. Criteria have been set for foreign manufacturers for the entry of their products into the United States.

CITRUS FRUITS.—The marketing of unripe fruit, sweated to improve its color in the effort to conceal inferiority, was stopped through court action. Food Inspection Decision 150 was issued to

prevent the marketing of fruit rendered worthless by the frost in California.

PHYSICIANS' SUPPLIES.—Special attention has been given to products of physicians' supply houses which do not pass through the usual trade channels of wholesale and retail drug houses and therefore escape the notice of inspectors. Many of these products were found to be adulterated or misbranded.

STANDARDIZING.

Because of a tendency during the past year to let contracts for Government supplies without calling for samples of materials for which there were adequate specifications, fewer samples of contract supplies have been tested than in preceding years. On the other hand, more satisfactory work has been done on the examination of very many samples of deliveries of goods of a miscellaneous character. A large number of the samples examined were submitted by other departments and often necessitated investigations. Statistics concerning the variation in paper caused by the effect on sizing of the various methods of drying have been accumulated. Several States have followed the advice of the Bureau of Chemistry in purchasing paper for their archives.

INVESTIGATIONAL.

CITRUS FRUIT BY-PRODUCTS.—The study of the utilization of waste oranges and lemons is approaching completion. The experimental work on the manufacture of citric acid from lemon juice is practically complete. It has been found that the fruit which has heretofore been discarded will yield from 15 to 60 pounds of citric acid per ton. The citric acid, at the prevailing market price of 35 to 45 cents a pound, renders these culls worth from \$5 to \$25 a ton. Special endeavor to devise methods for the recovery of the essential oil in quantity from both oranges and lemons has resulted in a method by which 60 per cent of the oil present can be recovered. A yield as high as 6½ pounds of essential oil of orange or lemon has been obtained from a ton of fruit. These citrus oils have a market value of \$2.50 to \$5 a pound. The gross maximum income a ton from the best quality of culls by methods thus far devised would therefore approximate \$45. The laboratory has been open for inspection to citrus growers and to others interested in this work. Several companies are considering the manufacture of these by-products.

FRUIT BY-PRODUCTS.—Studies on the utilization of waste fruits were conducted in collaboration with the Bureau of Plant Industry to further the preservation and concentration of fruit juices. The studies on fruit respiration have been continued in collaboration with the Office of Experiment Stations, the work on bananas being practically completed.

GRAPES.—The estimation of the acid content of ripening Concord and Catawba grapes showed that the total tartaric-acid content is fairly constant in the green and ripe fruit, and that the malic-acid content is variable; that malic acid is eliminated during ripening, so that at full ripeness this acid is much less in quantity than the tar-

taric acid; that the amount of cream of tartar in the juice samples and in the water extract of the same whole fruit shows that this salt increases in the fruit during ripening; that cream of tartar is deposited as crystals in the ripening fruit; that free tartaric acid is always present in considerable quantity in green and in partially ripened fruit, but that in the well-ripened fruit it disappears to such an extent that the crushed and cold-pressed fruit often shows none at all.

The analytical results of technical samples of wines are now sufficiently completed to allow the determination of sophistication of native wines with starch-sugar, and also with cane sugar where this is used in any considerable amount. The chemical studies of normal pure wines and sophisticated wines from American native grapes have shown that under average climatic conditions a sound wine high enough in alcohol and low enough in acid can, with slight exceptions, be more easily produced than is commonly claimed. The slight exceptions are Ives and Concord grapes, which tend to have a low sugar content, while Clinton, Norton, and, occasionally, Catawba grapes tend to have a high acidity. Storage and maturing of these wines in wooden containers assist in bringing them into potable condition through the beneficial effects of fermentation processes which destroy the malic acid, and the natural precipitation of cream of tartar which takes place under these conditions is markedly beneficial to the product.

GRAPE JUICE.—Two field laboratories were established during the season for the manufacture of grape juice, one at Highland, N. Y., and one at Westfield, N. Y. The limits of variation in composition of the juice were studied to learn how to detect added water and to determine the cause of the presence of small amounts of alcohol in grape juice ready for the market. The results of this work show that the alcohol present is due to fermentation during pressing the grapes, and that no fermentation takes place in the juice after it is stored. This is important information, since fermentation decomposes some of the sugar naturally present in the grape and necessitates the addition of sugar to sweeten the finished product.

WILD CHERRIES.—A study of the products of the wild cherry was made, and information concerning the composition of this fruit, widely used as a flavor, has been obtained.

CRUDE DRUGS.—Analyses have been made of a large number of samples of anise and fennel seeds and cubeb berries to set standards for the composition of the pure articles and to detect the admixture of inferior or exhausted seeds. A method was developed to distinguish the genuine Peru balsam from imitation and from mixtures. The analytical part of the investigation of the adulteration of pyrethrum, or insect powder, has been completed. Results of the investigation of oil of chenopodium show that ascaridole, the medicinally active constituent of wormseed oil on which the vermifuge properties of the oil depend, is a very unstable compound of the peroxid type. Its relations to other compounds have been elucidated, and a number of new and interesting substances prepared from it.

CONDIMENTS.—The results of the examination of a large number of samples of pepper showed that the requirements in the standards given in Circular 19, Office of the Secretary, in regard to sand in pod

peppers are too low for the commercial product imported at the present time into the United States.

The proper conditions for detecting charlock, a common weed seed, in ground mustard and prepared mustard by chloral hydrate solution have been determined. Information has been collected concerning the occurrence of charlock in grain fields, the separation of the seed from grain, and the utilization of the seed for the production of oil and the practice of using ground charlock as an adulterant of mustard preparations.

An investigation of the impurities in table, dairy, and other grades of salt manufactured from the Ohio River Valley brines has been completed. Special search was made to detect in these brines the presence of poisonous barium chlorid.

Information furnished by the Bureau of Animal Industry indicated that a great many of the spices used by meat and sausage packing establishments were adulterated or misbranded. This prompted a general investigation of the subject by the inspectors and the collection of a great many samples for technical examination.

POULTRY AND EGGS.—The food research laboratory has extended to Missouri and contiguous States the demonstration of suitable marketing of poultry and eggs as conducted during two preceding years in Tennessee and Kentucky. A remodeled refrigerator car, in which mechanical refrigeration has been installed, has carried into the small towns a practical demonstration of the benefits to be derived by careful preparation for market combined with refrigeration. Ten carloads of turkeys, chilled in this refrigerating plant, were shipped to the North from Kentucky for the Thanksgiving and Christmas markets. In spite of the warm weather prevailing all arrived in excellent condition. Late in the year a study of breakage of eggs during transportation was begun. As the result of the work of the Bureau of Chemistry three establishments started the sanitary preparation of frozen and dried eggs in the producing section of the Middle West. A study of the methods for detecting the time of storage of eggs has been completed. During the summer of 1912 the deterioration of eggs and egg products was studied. The bacteriological laboratory investigated bacteriological changes in shell eggs preserved in varying solutions of sodium silicate. A method for the determination of reducing sugars in eggs was devised to ascertain the sugar content of yolks and whites. The decomposition of the sugar present in the egg by inoculation with *B. coli* was also studied. The results obtained indicate that the determination of reducing sugars may be applicable in judging the quality of frozen or dried eggs.

CORN MEAL.—The Chicago and Savannah laboratories have jointly investigated spoilage in corn meal. Through the cooperation of one of the mills visited shipments of bolted and of roller-process meal from degerminated corn were made under controlled conditions. This meal, stored in commercial warehouses under trade conditions, is being examined at stated intervals to determine the changes taking place. It is proposed to include unbolted, undegerminated, and stone-ground meal in future experiments. An effort has been made to secure the adoption of a uniform method for determining moisture, thus reducing this common source of disagreement to a minimum. At the same time this investigation will furnish valuable data for

the enforcement of the net-weight amendment. It will also determine the permissible limit of moisture in corn meal. Moisture is the most important factor in spoilage. Spoilage of corn meal has become a most important hygienic question in the South because of its alleged relation to pellagra.

GELATIN.—The investigation of gelatin has been continued. Results obtained show the presence in gelatin of such metallic impurities as zinc, copper, arsenic, and lead. The cause of these impurities has been shown to be the action of sulphurous acid on the zinc and copper containers during manufacture. This work will enable the manufacturers to avoid introducing these impurities into gelatin.

SUGARS AND SIRUPS.—A method for the crystallization of raffinose, one of the sugars from cottonseed meal, was devised, making possible a thorough study of this sugar. The experimental work in sorghum sirups has included manufacture on a small scale in eastern Kentucky, testing various methods of clarification, such as settling, heating, or addition of lime. Special investigations of maple sirup have been made to show the effect of the composition of the evaporators and buckets on the appearance and flavor of the sirups. Pure cane sugar is being prepared for use in determining the polariscopic standards for cane sugar. Cane sugar has been estimated by means of an enzym from yeast.

INSECTICIDES.—An investigation has been made of the toxic effect on fruit trees of certain constituents used in insecticides, notably copper and arsenic. Apprehension has been entertained by some, especially the orchardists of the semiarid or irrigated districts of the West, that the continued use of the large amount of spray containing these substances might ultimately result in a serious accumulation in the soil and consequent injury of the tree through absorption of poison by the roots.

CANNED FOODS.—The work of the canning laboratory established in California has been continued. Some of the investigations dealt with the best methods for canning the fruits and vegetables of the Pacific coast, all of which differ in composition from those of the East. Investigations of jelly making have been begun.

As a result of studies of the packing methods of canned white beans and pork and beans, it is now possible to judge when imperfect beans have been used. It was found that because of the competition in the market moldy and decomposed beans were used by some canners for certain grades.

The effect of feeding shellac to laboratory animals was studied, since shellac is now used to line tin cans to prevent corrosion. Shellac is also used in finishing certain kinds of candies.

Collaboration was continued in Washington with the Commissary General of the War Department and with the National Canners' Association to learn the effect of storage on canned foods, the gases normally within the cans, and contamination of the contents of the cans with heavy metals dissolved from the cans.

COAL-TAR DYES.—Special attention has been paid to amaranth, orange I, ponceau 3 R, and naphthol yellow S. A number of quantitative tests for individual coloring matters in food have been devised.

ANALYTICAL METHODS.—Investigations of analytical methods of various kinds are always needed in conducting various lines of work. Among those recently studied are: Methods for the examination of asafetida; the detection of small quantities of strychnin in the presence of large quantities of quinin; the determination of moisture, arsenic, and lead; and the determination of tin in canned goods. Some of this work is done in cooperation with the Association of Official Agricultural Chemists. The method on which the leather and paper laboratory has worked in cooperation with the American Leather Chemists' Association for determining glucose in leather has been fully established in this laboratory and made the official method of the association. The contracts laboratory has cooperated in a similar way with the American Society for Testing Materials and with the Bureau of Standards.

PHARMACOLOGICAL INVESTIGATIONS.—Information was obtained concerning the action of caffen under a variety of conditions. Acute and chronic intoxications with salts of tin were studied and observations upon the action of tartrates were made.

LEATHER.—Work has been undertaken to determine by experiment the durability of sole leather of different tannages, loaded and unloaded, oiled and unoled, rolled and unrolled, bleached and unbleached. For this investigation and for the purpose of developing a laboratory method to determine durability of leathers, a machine has been designed for the purpose of imitating as closely as practicable the effect of wearing on sole leathers. A method whereby the kind of skin from which a piece of leather was made can be determined from a small piece of leather has been published. Work has been done in collaboration with the American Leather Chemists' Association on the disposal of tannery and leather wastes.

UTILIZATION OF WOOD WASTE.—Investigations on an industrial scale are in progress in wood distillation, and in the separation and refining of products therefrom, to secure information on the best conditions of preparation, and to develop best forms of apparatus for maximum yields of the several products. The work so far indicates that it is practicable to reduce the time required for distillation and to obtain larger yields of better quality of certain products. Successful experiments have been conducted in the separation of resin oils from the heavy oils obtained in the destructive distillation of resinous woods. The work to improve the quality of wood turpentine and to determine their technical value and their toxic effects, when used as paint and varnish thinners as well as when used for drug purposes, has been continued.

REPORT OF THE CHIEF OF THE BUREAU OF SOILS.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., November 1, 1913.

SIR: I have the honor to transmit herewith a report covering the operations of the Bureau of Soils for the fiscal year ended June 30, 1913.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

HON. D. F. HOUSTON,
Secretary of Agriculture.

The work of the soil survey has been prosecuted under direction of Prof. Curtis F. Marbut, the work of the chemical and physical laboratories, including fertilizer investigations, under direction of Dr. Frank K. Cameron, and the work of soil-fertility investigations under direction of Dr. Oswald Schreiner.

SOIL SURVEY.

PROGRESS OF THE WORK.

During the year ended June 30, 1913, an area amounting to 52,609,600 acres, or 80,640 square miles, was covered by soil surveys. Of this amount 33,142 square miles, or 21,210,880 acres, were surveyed and mapped in detail, and the maps covering this area will be prepared on the scale of 1 inch to 1 mile. Parts of 31 States were included in this work, and all sections of the country were represented. The rest of the area, 47,498 square miles, or 30,398,720 acres, was covered by reconnoissance surveys and the results published on scales of 4 or 6 miles to an inch.

Reconnoissance surveys determine the general facts regarding the classification and distribution of the soils. Minute details of distribution are not shown, as upon the detailed maps.

The total area covered by the soil survey during the fiscal year 1913 is comprised in 76 individual areas or projects, 47 of which were begun within the year.

The total area of soils mapped in the United States from the beginning of the work in 1899 to June 30, 1913, deducting the areas of

overlap between the detailed and reconnaissance surveys, is 703,235 square miles, or 450,070,400 acres. This comprises an area equal to about 31 per cent of the soils of the United States east of the Rocky Mountains.

The following tables show the details of the areas surveyed during the year and the total area surveyed in each State up to the present time:

Individual areas surveyed and mapped during the fiscal year ended June 30, 1913.

DETAILED.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
Alabama.....	Bullock County.....	375	240,000
	Cleburne County.....	442	282,880
	Conecuh County.....	¹ 613	392,320
	Covington County.....	¹ 524	335,360
	Escambia County.....	505	323,200
	Russell County.....	323	206,720
Arkansas.....	Ashley County.....	¹ 374	239,360
	Pope County.....	509	325,760
California.....	Merced area.....	463	296,320
Connecticut.....	New London County.....	659	421,760
Florida.....	Bradford County.....	555	355,200
	East Coast area.....	500	320,000
	Pinellas County.....	300	192,000
Georgia.....	Chattooga County.....	¹ 142	90,880
	Jeff Davis County.....	350	224,000
	Jones County.....	397	254,080
	Miller County.....	281	179,840
	Stewart County.....	440	281,600
	Talbot County.....	360	230,400
Illinois.....	Will County.....	845	540,800
Indiana.....	Boone County.....	¹ 202	129,280
	Hamilton County.....	399	255,360
	Hendricks County.....	255	163,200
	Montgomery County.....	¹ 356	227,840
	Tipton County.....	¹ 105	67,200
Iowa.....	Bremer County.....	139	88,960
Kansas.....	Cherokee County.....	¹ 462	295,680
	Greenwood County.....	¹ 890	569,600
	Jewell County.....	¹ 675	432,000
	Christian County.....	¹ 550	352,000
Kentucky.....	Genesee County.....	655	419,200
Michigan.....	Goodhue County.....	¹ 590	377,600
Minnesota.....	Jones County.....	474	303,360
Mississippi.....	Lafayette County.....	676	432,640
	Wilkinson County.....	450	288,000
Missouri.....	Barton County.....	590	377,600
	Carroll County.....	¹ 420	268,800
	Cass County.....	¹ 415	265,600
	Greene County.....	202	129,280
	Miller County.....	¹ 455	291,200
	Nodaway County.....	140	89,600
	Perry County.....	103	69,120
	Pike County.....	¹ 520	332,800
	Ralls County.....	235	150,400
	Stoddard County.....	¹ 415	265,600
Nebraska.....	Otoe County.....	¹ 391	250,240
	Saunders County.....	400	256,000
New Jersey.....	Freehold area.....	262	167,680
New York.....	Oneida County.....	546	349,440
	Orange County.....	¹ 679	434,560
North Carolina.....	Ashe County.....	427	273,280
	Wake County.....	261	167,040
North Dakota.....	Barnes County.....	¹ 366	234,240
Oklahoma.....	Muskogee County.....	480	307,200
Oregon.....	Hood River-White Salmon area.....	¹ 112	71,680
Pennsylvania.....	Lehigh County.....	344	220,160
	York County.....	¹ 758	485,120
South Carolina.....	Bamberg County.....	380	243,200
	Orangeburg County.....	¹ 131	723,840
	Union County.....	495	316,800

¹ These figures do not include portions of these areas surveyed in preceding years.

Individual areas surveyed and mapped during the fiscal year ended June 30, 1913.—Continued.

DETAILED—Continued.

State.	Area.	Area surveyed.	
		Square miles.	Acres.
Tennessee.....	Putnam County.....	404	258,560
	Robertson County.....	¹ 345	220,800
Texas.....	Jefferson County.....	920	588,800
	Washington County.....	538	344,320
Utah.....	Cache Valley area.....	450	288,000
Virginia.....	Henrico County.....	277	177,280
Washington.....	Stevens County.....	195	124,800
West Virginia.....	Kanawha County.....	872	558,080
	Preston County.....	¹ 330	211,200
Wisconsin.....	Buffalo County.....	¹ 235	150,400
	Dane County.....	¹ 789	504,960
	Jefferson County.....	¹ 420	268,800
Total.....		33,142	21,210,880

RECONNOISSANCE.

Ohio.....	State.....	¹ 32,760	20,966,400
Pennsylvania.....	Southeastern area.....	¹ 8,554	5,474,560
Texas.....	South-central area.....	¹ 4,912	3,143,680
Wisconsin.....	Northeastern area.....	¹ 1,272	814,080
Total.....		47,498	30,398,720

¹ These figures do not include portions of these areas surveyed in preceding years.

Total areas surveyed and mapped in the several States during the fiscal year ended June 30, 1913, and the areas previously reported.

DETAILED.

State or Territory.	Work during 1913.	Work previously reported.	Total.	
	Sq. miles.	Sq. miles.	Sq. miles.	Acres.
Alabama.....	2,782	29,940	32,722	20,942,080
Arizona.....		611	611	391,040
Arkansas.....	883	3,277	4,160	2,662,400
California.....	463	12,931	13,394	8,572,160
Colorado.....		2,809	2,809	1,797,760
Connecticut.....	659	1,045	1,704	1,090,560
Delaware.....		314	314	200,960
Florida.....	1,355	4,763	6,118	3,915,520
Georgia.....	1,970	9,059	11,029	7,058,560
Idaho.....		1,281	1,281	819,840
Illinois.....	845	5,925	6,770	4,332,800
Indiana.....	1,317	4,729	6,046	3,869,440
Iowa.....	139	2,303	2,442	1,562,880
Kansas.....	2,027	5,595	7,622	4,878,080
Kentucky.....	550	2,519	3,069	1,964,160
Louisiana.....		9,210	9,210	5,894,400
Maine.....		939	939	600,960
Maryland.....		4,060	4,060	2,598,400
Massachusetts.....		1,494	1,494	956,160
Michigan.....	655	4,360	5,015	3,209,600
Minnesota.....	590	2,908	3,498	2,238,720
Mississippi.....	1,600	13,206	14,806	9,475,840
Missouri.....	3,500	15,049	18,549	11,871,360
Montana.....		432	432	276,480
Nebraska.....	791	3,331	4,122	2,638,080
Nevada.....		235	235	150,400
New Hampshire.....		1,411	1,411	903,040
New Jersey.....	262	2,164	2,426	1,552,640
New Mexico.....		596	596	381,440
New York.....	1,225	10,224	11,449	7,327,360
North Carolina.....	688	15,286	15,974	10,223,360
North Dakota.....	1,366	6,166	7,532	4,820,480

Total areas surveyed and mapped in the several States, etc.—Continued.

DETAILED—Continued.

State or Territory.	Work during 1913.	Work previously reported.	Total.	
	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Acres.</i>
Ohio.....		4,800	4,800	3,072,000
Oklahoma.....	480	1,160	1,640	1,049,600
Oregon.....	112	1,853	1,965	1,257,600
Pennsylvania.....	1,102	9,793	10,895	6,972,800
Porto Rico.....		330	330	211,200
Rhode Island.....		1,085	1,085	694,400
South Carolina.....	2,006	11,775	13,781	8,819,840
South Dakota.....		675	675	432,000
Tennessee.....	749	6,292	7,041	4,506,240
Texas.....	1,458	18,006	19,464	12,456,960
Utah.....	450	1,501	1,951	1,248,640
Vermont.....		227	227	145,280
Virginia.....	277	6,437	6,714	4,296,960
Washington.....	195	1,652	1,847	1,182,080
West Virginia.....	1,202	8,157	9,359	5,989,760
Wisconsin.....	1,444	8,452	9,896	6,333,440
Wyoming.....		309	309	197,760
Total.....	33,142	260,676	293,818	188,043,520

RECONNOISSANCE.

Arkansas-Missouri.....		58,000	58,000	37,120,000
Kansas.....		39,960	39,960	25,574,400
Nebraska.....		53,064	53,064	33,960,960
North Dakota.....		39,240	39,240	25,113,600
Ohio.....	32,760	8,660	41,420	26,508,800
Pennsylvania.....	8,554	32,851	41,405	26,499,200
South Dakota.....		41,400	41,400	26,496,000
Texas.....	4,912	87,385	92,297	59,070,080
Washington.....		13,115	13,115	8,393,600
Wisconsin.....	1,272	1,747	3,019	1,932,160
Total.....	47,498	375,422	422,920	270,668,800

COOPERATION.

The number of cooperating States remains the same as for 1912. The bureau has received financial cooperation from Alabama, Georgia, Indiana, Iowa, Kansas, Missouri, Mississippi, Nebraska, New York, New Jersey, North Carolina, North Dakota, Ohio, Pennsylvania, Tennessee, Washington, West Virginia, and Wisconsin. Plans have been perfected and agreed upon for taking up cooperative work with California at the beginning of the new fiscal year, and cooperation in Minnesota is only temporarily delayed and will be taken up in the near future. The work with Washington, suspended during 1912, was resumed in 1913.

The most of the cooperating States lie within the region where field work is possible in the warmer seasons of the year only. But three States lie within the region where field work is possible during the entire year. In order to carry out the cooperative agreement in the Northern States practically the whole force of the soil survey must be kept in the cooperating States, so that practically none of the staff is available for work in the noncooperating Northern States. During the northern field season, begun in the latter part of the fiscal year 1913, only four projects could be taken up in the noncooperating States. Attention has repeatedly been called to the rapid growth of cooperation with some of the States and the prac-

tical impossibility of prosecuting soil-survey work during the summer season in noncooperating States unless the appropriations for the bureau are increased.

In the winter season, however, when the whole survey staff must be massed in the South Atlantic and Gulf States, we are able to do much more work in the noncooperating States, on account of the smaller demand of the few cooperating States in that section.

SOILS OF THE UNITED STATES.

In the report for 1912 attention was called to the work of preparing a comprehensive descriptive catalogue of the soils of the United States. The compilation of this work was begun in 1912 and finished and published as Bulletin No. 96 of this bureau in 1913. It covers the soils of the whole country, so far as they are known at present. It includes descriptions of soils from every State in the Union.

SOIL CLASSIFICATION.

The increased amount of work done by the bureau and the increasing demands for more accurate work have made it necessary to increase the force of men engaged in supervising the field work and classifying and correlating the soils. The northern and southern inspection districts have been divided into two each and a man placed in charge, increasing the force to five men.

RECONNOISSANCE SOIL SURVEYS.

The reconnoissance soil surveys of Ohio and Pennsylvania were completed last year. At the close of the year there is no pressing demand for this work in any of the States within the humid region. It is becoming generally recognized that reconnoissance surveys do not meet the requirements of agriculture in the humid region except in those rare instances where the soils are uniform over large areas. In the latter case detailed surveys are about as easily and rapidly and cheaply made as reconnoissance surveys. Reconnoissance surveys are of greatest value in areas where the soils are uniform over large areas and where they are undeveloped. The information obtained in reconnoissance work is valuable in such cases as a guide to the settlement of such a region. A wide distribution over a State of a number of soil surveys will usually enable a student to draw conclusions as to the nature of the soil in the intervening unsurveyed areas very nearly as accurately as can be done from rapid reconnoissance work. Plans are being perfected by which the bureau will be able to assign permanently to those States prepared to use him a soil expert who will be the official soil adviser to the State and Government workers in the State. His work will make the preparation of the confessedly temporary reconnoissance work unnecessary in the States.

LAND CLASSIFICATION IN THE NATIONAL FORESTS.

The work of land classification was begun in cooperation with the Forest Service in the early part of the fiscal year. Four of the most mature and experienced men on the bureau's staff were assigned to that work. In April, 1913, five additional men were assigned to this work. A number of projects were surveyed, classified, and reported on, while a number of others were surveyed and classified and were

ready to be reported at the close of the year. The methods of work had to be planned and standardized, but before the close of the year this had been done and the work was going forward at a satisfactory rate.

THE USE OF SOILS.

The work of studying the great soil groups of the country with especial reference to the crops that are grown on and adapted to them has been continued. A bulletin on the Norfolk soils of the Atlantic and Gulf Coast States has been prepared for publication, as well as one on the Clyde soils of the extreme northern States. Field work is in progress on the great Miami group of soils and it is expected that a report will be prepared before the close of 1914.

SPECIAL CROP SOILS.

The study of soils as related to special crops has been in progress for a few years past, especially the study of soils devoted to the growing of apples. Work was done in 1911 on the apple soils of Massachusetts, and similar work in 1912 was carried on in Connecticut. The results of these studies have been combined in a report on the fruit soils of southern New England. A similar study is in progress in New York.

FERTILIZER INVESTIGATIONS.

The investigation of the fertilizer resources of the United States has shown that ample supplies of raw materials are available within the confines of the Nation to supply its needs for many years to come. The available supplies of high-grade phosphate rock is sufficient to meet the demands of the entire world for centuries. The giant kelps of the Pacific coast can meet annually several times the present national requirements for potash salts, besides which there is promise of an important supply from alunite and feldspar, of which large deposits have been located in this country. Ammoniates from by-product coke ovens, cottonseed-mill refuse, fish scrap, slaughter-house refuse, city wastes, etc., can be greatly augmented by the introduction of improved methods, and, above everything else, work now in progress indicates that improved methods of nitrogen fixation may make practical under American conditions the utilization of the nitrogen of the air by the factory as well as by leguminous crops.

SOIL-FERTILITY INVESTIGATIONS.

The isolation and identification of organic compounds in different soils has progressed from year to year, and in the past year some especially noteworthy results have been obtained which shed further light upon the nature of soil humus and the biochemical relationships existing in the soil. A considerable number of new soils have come under observation during the year, and the horizon of soil study in this field has materially broadened. A very large number of such soil compounds are now known, as the result of this work. The soil compounds discovered belong to the acids, aldehydes, and bases. The acid compounds discovered are especially interesting in that they are representative of a chemical class of acids not found in our pre-

vious work and throw a new light upon some of the organic transformations in soils. The aldehyde is likewise interesting in this respect, and the nitrogen compound is unique among those so far isolated in being a transformation product of uric acid, a constituent of urine. This discovery reveals some of the relationships existing between the oxidation products of this important manure constituent.

During the year the nature and quantities obtainable of several soil constituents permitted their use in field tests at the Arlington Farm. Several of the substances determined to be toxic in cultures in the greenhouse were used in these tests, and several crops were grown to maturity in the field treated with these compounds. The results confirmed the greenhouse studies in showing decided harmful effects on all the crops grown, both as to general vegetative growth and yield of crop under these field conditions.

The greenhouse studies with the soil constituents isolated from various soils have been continued, and a considerable number of compounds have been further investigated in respect to their effects on plant growth. Some of these, like those previously studied, were found to be beneficial, some harmful, and some without effect. Of the harmful substances studied in the last year salicylic aldehyde was found to be even more toxic than the compounds previously described, causing serious disturbances in the plant in as low concentrations as ten parts per million. Its effect was tested on a large number of plants, including wheat, corn, cowpeas, cabbage, clover, rice, string beans, and garden peas, and in each case its harmful influence was demonstrated. Like the corresponding acid, it is a strong antiseptic, inhibiting the action of bacteria. A remarkable fact in connection with the soil in which it was found was that this contained also a large amount of mannite, as much as 500 pounds per acre. Although this is the only soil thus far in which mannite has been found, the remarkable part was not in its being found there, for it can be readily produced by certain soil fungi, but rather that it should persist in the soil, when it is such an excellent medium for the development of bacteria. The simultaneous presence of the salicylic aldehyde in the soil and the fact that the latter was poisonous to higher plants suggested, therefore, that the mannite in the soil was protected by the antiseptic action of the salicylic aldehyde. Experiments confirmed the antiseptic action of the salicylic aldehyde in preventing the decomposition of mannite, and the occurrence of the large quantity of mannite in this soil seems thereby explained. This is particularly interesting in showing that soil compounds affect the lower life of the soil as well as the higher plant life, and through these the entire biochemical process, and furthermore, that even if a compound like mannite be not toxic in itself, its very presence points to the fact that the soil is functioning abnormally, much as the presence of sugar or albumen in the urine, in themselves harmless, point to the fact that something is decidedly abnormal with the metabolism of the individual excreting them.

The question of origin of the compounds found in soils is necessarily an important one and received further attention during the year. It has become quite clear as the result of these researches that plant roots contribute some of these compounds to the soil or water in which they grow, and also that molds contribute such substances, both as the result of their own life processes and after the death of

the cells. The origin of the harmful constituents seems to be the most difficult to determine. Although the number of toxic soil constituents may be very large and probably but imperfectly represented by those we have thus far been able to isolate, it nevertheless appears significant that we have found them to be substances which have reducing properties and under favorable conditions are subject to further oxidation. They may be said to have found their origin under imperfect conditions of oxidation, or aeration, whether this be the direct result of poor drainage, of soil acidity, or lack of lime, of poor cultivation, or of the growth of crops which do not promote deep root growth or active root oxidation.

Compounds of an aldehyde nature are of this type of intermediary oxidation products, and several have already been identified in soils and shown to have harmful properties. Accordingly, a survey of aldehydelike constituents was made in soils from many parts of the United States. The aldehyde fraction was separated from the soil by approved chemical methods, and the effect on plant growth was determined. Good and poor soils from many parts of the United States were obtained through the soil survey and studied in this manner. The results showed a striking relationship between the occurrence of aldehyde constituents and the infertility in that such compounds were practically encountered only in soils designated as poor or infertile, and that this aldehyde fraction from poor soils was uniformly toxic to plants in the greenhouse culture work, whereas good soils similarly extracted gave but seldom an indication either of aldehyde compounds or of a harmful property.

The studies which we have made on soils in respect to their ability to oxidize organic substances such as aloin has shown that fertile soils are generally good oxidizers and infertile soils poor oxidizers. In soils that are good oxidizers the chances of having an undue accumulation or even formation of toxic substances are at a minimum, whereas in poor soils with low oxidizing power, with low vitality, as it were, to digest properly the organic refuse of previous growth, harmful substances result.

The effect of certain catalytic fertilizers, such as manganese, on plants in solution cultures, in soils in the greenhouse, and in the field has been actively studied. A 5-year test on the soil at Arlington Farm with a great variety of crops has shown conclusively that no beneficial results are obtained by its use. This result was neither in harmony with claims by some European investigations, although the results of others were likewise contradictory in character, nor in harmony with our own greenhouse cultures, which had shown in the case of poor soils a very promising stimulation through the use of manganese. The negative result of the field test was traced to the acid tendency of the soil, and the results prove conclusively that manganese on such soils can not give good results. This field experiment is being continued, after liming the soil to produce neutrality. Both in soils and solutions the influence of the manganese was to increase the oxidation, and to this property is ascribed its effectiveness in practice. The results obtained throw much light upon the mooted question of the action of this type of material in soils and in fertilizers, and the results clearly show that the nature of the manganese compounds and the nature of the organic matter in the soil determine the effectiveness of its action in promoting increased crop growth.

REPORT OF THE ENTOMOLOGIST.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY,
Washington, D. C., August 15, 1913.

SIR: I submit herewith a report on the work of the Bureau of Entomology for the fiscal year ending June 30, 1913.

Respectfully,

L. O. HOWARD,
Entomologist and Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

SUMMARY OF RESULTS OF NEW WORK AND OF PROGRESS IN THE OLDER INVESTIGATIONS.

WORK ON THE GIPSY AND BROWN-TAIL MOTHS.

Important changes have been made during the year in the organization of the work being carried on against these insects, the direction of the whole investigation being placed in the hands of Mr. A. F. Burgess, and the operations being divided into four different sections, with a trained man at the head of each.

The field work for the prevention of the spread of the gipsy moth has been divided along two main lines, namely: Scouting work for the purpose of determining the limits of infestation and the prevention of spread by natural and artificial means, mainly along the borders of the infested territory; and quarantine work, which is conducted for the purpose of preventing long-distance carriage of the insects by the egg clusters of the gipsy moth or the winter webs of the brown-tail moth on nursery stock or forest products by railroads, steamship lines, or other methods of transportation. The scouting work of the past winter indicated a spread in the towns along the seacoast and northward in the State of Maine, and a lesser spread to the northward and westward in New Hampshire. In Massachusetts there has been some spread in the northern part of the State along the western border of infestation. The scouting work was accompanied by a vigorous attempt to clean up the infested localities along the western border, and a marked decrease was apparent at the close of the fiscal year. The condition of the woodlands within a radius of 20 miles of Boston, except to the south and southeast, was much better at the close of the fiscal year than it had been since the work was begun by this bureau six years ago.

The gipsy moth in New York.—The infestation discovered last year in the State of New York at Geneva has received thorough attention.

The extermination work conducted by the State department of agriculture was evidently very efficiently performed. The surrounding territory has been scouted by trained men of the Bureau of Entomology, and as a result of the thorough treatment carried on during the winter no caterpillars were found in 1913.

Carriage of young larvæ by wind.—Careful experiments have been conducted which show that newly hatched caterpillars may be blown, under favorable conditions, a distance of 6 miles or more. Fortunately, the strong winds, which are accompanied by high temperature during the time the caterpillars are small enough to be distributed in this way, blow from the south and southwest, so that the natural trend of dispersion is toward the north and northeast. If this were not so, little hope could be entertained of preventing the rapid spread of the insect to the westward.

The wilt disease of the gipsy moth.—Cooperative work has been carried on between the bureau and the Bussey Institution of Harvard University with the wilt disease. An experienced bacteriologist has been employed by the bureau to continue work at the Bussey Institution on the technical aspects of the investigation. The influence which different food plants have on the development of the disease is being carefully studied, together with temperature and humidity conditions, both in the laboratory and in the field.

Introduced parasites.—No attempt has been made during the year to import additional parasites. It is considered that little would be gained, in comparison with the necessary expenditure of funds, in bringing over additional quantities of parasites of species which have already apparently established themselves in this country. It may be that an effort will be made another year to find parasites which have not yet taken hold in the United States. Owing to the fact that one of the imported egg parasites (*Anastatus bifasciatus*) spreads very slowly, extensive collections were made during the winter of parasitized gipsy moth egg clusters from colonies that were planted the previous year. From this material it has been possible to liberate 1,500,000 parasites of this species, and these have been placed in 1,500 colonies in sections where the insects have not become established. Eight hundred colonies were planted in towns along the western border of infestation, and the balance have been liberated in a number of towns in the northern part of Massachusetts. The Japanese egg parasite (*Schedius kuvanae*) has decidedly increased, and in some cases has spread for a distance of a mile and a half from the point of planting. One of the European tachinid flies (*Comptosilura concinnata*) has become very abundant over a large territory. Several of the other species of imported parasites have been doing remarkably well. *Apanteles lacteicolor* has been found attacking gipsy moth caterpillars in widely separated sections of the infested area and seems to be multiplying more rapidly than any of the others that have been imported. Forty-four thousand cocoons of this species were placed in New Hampshire, and a slightly smaller number were placed in Maine. Similar plantings have been made in Rhode Island and Connecticut. The *Calosoma* beetle, which has been favorably mentioned in previous reports, has increased greatly dur-

ing the past year, although it has not spread as rapidly as the hymenopterous parasites. Colonies have been planted in southeastern Massachusetts and in Rhode Island, and a large number of other colonies will be placed in New Hampshire before the close of the present summer. Altogether the situation as to parasitic and predatory enemies is very favorable, and these importations, together with the wilt disease, have rendered conditions in the woodlands in the center of the infested area much more promising than ever before.

Experimental food-plant and silvicultural work.—Experiments carried on for the purpose of investigating in detail the feeding habits of the gipsy-moth caterpillars on all of the native forest trees and undergrowth which occur in New England have had interesting results, but this work is as yet in its infancy. Arrangements were made last year with the Forest Service for cooperative work on a series of experiments to determine whether the most common forest trees of New England will be able to survive the attacks of the gipsy and brown-tail moths if the woodlands are placed in the best possible silvicultural condition. In making these experiments careful consideration is being given to the trees of the greatest commercial value. Areas of mixed woodland have been selected in Maine, New Hampshire, and Massachusetts and divided into plots based upon different types of tree growth. As the gipsy-moth question is now almost entirely a forest question, it is important that active work should be carried on to place especially the mixed forests in such condition that they will resist the attacks of the insect and survive. The experiments now being carried on, it is hoped, will serve as demonstrations to the owners of woodlands in New England and other regions to which the gipsy and brown-tail moths may spread, of the possibility of not only saving their forests, but perhaps of securing better stands of more valuable material.

DECIDUOUS FRUIT INSECT INVESTIGATIONS.

The investigation of insects injurious to deciduous fruits is under the immediate charge of Mr. A. L. Quaintance.

Cranberry insect work.—The investigation of the cranberry insects of Wisconsin has been completed and a report submitted for publication. In response to requests from cranberry growers in New Jersey an inquiry into the insect pests of this crop in that State was undertaken, beginning with the spring of 1913. A thorough investigation of the principal insect enemies of cranberry in that State will be made, some of them being comparatively well known. A new and destructive enemy of this crop, similar in habits and destructiveness to the grape rootworm in vineyards, will be studied.

Grape Phylloxera investigations.—Material advance has been made in the studies in California of grape Phylloxera. The life-history studies in progress in the laboratory at Walnut Creek, Cal., will, it is believed, be fairly well completed at the close of the present season. Especial attention is being given to the life-history work, in order to ascertain the means of spread in vineyards and upon

nursery stock under California conditions. Relative degrees of resistance to the insect of the roots of different varieties is being studied, and vineyard renovation work is also in progress in order that it may be studied from the entomological point of view.

Insects affecting nuts.—Especial attention is being given to the insect pests of the pecan in the South where the pecan industry has assumed large proportions. Certain insects are very destructive to this crop, especially a bud worm destroying the opening buds in the spring, a husk worm feeding upon and destroying the young nuts, and different species of Phylloxera and certain borers. Headquarters were established in the spring of 1913 at Monticello, Fla., and the investigation will be extended to other pecan-growing regions, as in Mississippi, Louisiana, and Texas.

In California the insect enemies of the walnut are under investigation, and a report upon three important species of walnut plant-lice has been completed and submitted for publication.

Orchard insecticide investigations.—Constant tests of insecticides are being made in the orchards, and of course especial attention is given to the development of new insecticides superior to those already in use. During the present year arsenate of lime, an arsenical not previously used in insecticide work, has been found to be superior in some respects as an orchard spray to other arsenicals. The lime-sulphur wash, hitherto regarded simply as a contact spray especially for scale insects, has been found to be of value as a stomach poison, with a toxicity approaching that of arsenate of lead. Extensive experiments are in progress in Michigan, Maine, and Arkansas with this wash to determine to what extent it may be substituted for arsenicals in spraying against the codling moth. The great demand for a combination spray against biting insects, sucking insects, and fungous diseases has necessitated much experimentation along this line, and an effective combination has been found in lime-sulphur wash, arsenate of lead, and a strong nicotine solution.

Other orchard insect work.—Special studies of orchard plant-lice have resulted in discoveries which materially affect control measures. Investigations of fruit-tree borers and fruit-tree scale insects have been carried on. The pear-thrips investigations have been so far completed that operations have been reduced, and the bureau's laboratory at San Jose, Cal., has been discontinued. Much demonstration spraying, however, was carried on in the spring of 1913, especial attention being given to the instruction of orchardists in the territory but recently invaded by the thrips.

Codling-moth investigations have been continued, especially in the development of a spraying schedule effective under different climatic conditions, and in New England an effort is being made to perfect a spraying schedule which will not only control ordinary orchard insect pests, such as the codling moth, plum curculio, and bud moth, but which will also be effective in destroying the gipsy and brown-tail moths. A study of the fruit-tree leaf-roller, which has been excessively troublesome in portions of Colorado, has been completed and an effective and practical treatment developed which has been largely adopted by orchardists.

SOUTHERN FIELD-CROP INSECTS.

Mr. W. D. Hunter is in charge of the investigations of insects infesting southern field crops.

Cotton-boll weevil.—The larger part of the experimental work on the cotton-boll weevil was conducted at a field laboratory at Tallulah, La. It consisted of field experiments located on different plantations. The work was interrupted rather seriously by the overflow of the Mississippi River, which inundated many of the experimental fields. In a number of cases it was possible to replant, so that satisfactory results were obtained. Experiments in the hand picking of the early appearing weevils and of the first infested squares, found of doubtful value in certain other regions, indicated that in the Mississippi Delta this process is well worth while. The profits from this measure ran from \$1 to \$6 per acre. The entire series gave an average increase in yield of \$3.32 per acre. The use of powdered arsenate of lead as a means of destroying hibernating weevils has shown that under certain conditions the use of the poison will be found to be profitable. The results of the overflow indicated that where local conditions are favorable artificial flooding of the fields may be resorted to with profit to the planters. The work on the introduction of parasites in the Mississippi Valley suffered greatly on account of floods. The washing out of large quantities of material infested with parasitized weevils made it impossible to determine accurately the results of introductions. Studies of the advance of the boll weevil into new regions indicated that 7,300 square miles of territory became infested for the first time during the season.

Work on tobacco insects.—This work consisted of investigations and demonstrations of means of control of the tobacco hornworms, the control of the cigarette beetle in cigar factories, the completion of the investigation of the tobacco wireworms, and preliminary experiments to determine the insects which transmit the mosaic disease. Arsenate of lead has been found effective against the hornworms and not injurious to the leaf. Work has been carried on to perfect an apparatus that will make a thorough and economical application of the poison. The work on the cigarette beetle was conducted at Tampa and Key West, Fla. Experiments in the use of cold storage and vacuums of different degrees, as well as of Roentgen rays, were carried on.

Sugar-cane insects.—Work upon the sugar-cane borer seems to show, from the local variation in the amount of damage due to this pest on different plantations, that the controlling factors are probably connected with plantation practices, and the work carried on will undoubtedly assist in forming plans for cultural means of control. An important egg parasite of the insect was observed for the first time. Several pests of considerable importance which were not known to occur in the United States were discovered. This work was carried on in cooperation with the Louisiana Sugar Experiment Stations and the Sugar Planters' Experiment Station in Porto Rico.

Rice insects.—This work was conducted at Crowley, La., in connection with the rice station of the Louisiana Experiment Stations. The biology of the insects concerned having been worked out, the

investigation during the year consisted largely of field experiments to determine the variations in methods of flooding the land as affecting the rice water weevil.

The cotton red spider.—Headquarters for this work was at Batesburg, S. C., although observations were made in other localities. The injury by this species seems to be restricted to rather definite localities. Experimental work dealt with the destruction of the red spider by chemical means and by cultural practices. The latter were much more satisfactory.

The Argentine ant.—The work on this destructive species consisted largely of an experiment in the extermination of the pest in a town in Mississippi in which it had recently become established. The best results were obtained with the use of a very dilute, sweetened solution of sodium arsenite.

INSECTS AFFECTING THE HEALTH OF MAN AND ANIMALS.

Investigations pertaining to insects affecting the health of man and animals are under the immediate direction of the chief of the bureau.

Possible connection of biting insects with the carriage of pellagra.—In cooperation with the Thompson-McFadden Commission, of the New York Postgraduate Medical School, observations and experiments were conducted in Spartanburg County, S. C. The several species of insects which may be connected with the transmission of the disease were studied carefully with relation to the cases of pellagra found and their histories. The work practically excluded the possibility of transmission by the buffalo gnat, but tended strongly to show the possibility of transmission by the stable fly. This latter insect is known as the conveyor of several diseases, and its habits and distribution are such that it may be found to be an important agent in the transmission of this disease.

The Rocky Mountain spotted-fever tick.—This work was interrupted during the season of 1912, but in view of the fact that a special appropriation for beginning this work on July 1, 1913, was made by the last Congress, it was resumed toward the close of the fiscal year. Cooperative arrangements were made with the Montana Board of Entomology for the eradication of the tick in the Bitter Root Valley.

Work on ticks.—Certain mooted points in the host relationship and habits of the cattle tick have been studied. The life histories of several species of ticks of importance as animal pests have been worked out, including the winter tick and the brown winter tick, the former species an important pest of horses, cattle, and elk in the northwestern part of the United States, and the latter troublesome in certain portions of the central States. Satisfactory control measures have been found for the fowl tick, a serious poultry pest in the Southwest, and a circular has been published.

INSECTS INJURIOUS TO CEREAL AND FORAGE CROPS.

Mr. F. M. Webster is in charge of work for the control of cereal and forage crop insects.

The alfalfa weevil.—Investigations of this insect continued through the fiscal year. Field experiments of a thoroughly practical nature

have shown such good results that alfalfa growers in the infested region have secured a fairly good crop of hay throughout the season. Some of the best alfalfa growers in this region now insist that they can secure a larger annual yield of hay than they were able to do before the pest appeared. Cultivation of the alfalfa fields in the fall permits the moisture from winter rains and gathering snows to penetrate the earth, while the cultivation encourages early growth, and this early and more vigorous growth anticipates the appearance of the weevils in large numbers. At present it is necessary to cut this crop prematurely, but this advances the second crop, so that the latter is harvested now only 10 days later than the first crop was formerly mown for hay. After taking off the premature first crop, brush dragging, and irrigation, where the latter is possible, not only reduces the numbers of the weevil but produces a much more vigorous second crop. The same follows for the third crop.

Present efforts are being concentrated upon devising some method of reducing the number of hibernating weevils and further reducing their numbers in the spring.

The introduction of parasites from southern Europe has been continued, and at least one species has been successfully introduced and apparently established.

The fall army worm.—This insect started in Florida in the spring of 1912 and gradually spread northward, generation after generation, until in the autumn it attacked the lawns not only in Washington but in New York City and other northern points. It also attacked timothy meadows, millet, and other late grain crops, even including fall wheat. It was quite destructive even as far north as northern Ohio, Indiana, Illinois, and central Iowa. It is controlled by spraying with arsenical mixtures. The 1912 outbreak was unusual. The insect hibernates successfully only in the most southern portions of the United States. During the winter of the present year its habits have been studied in Florida and at Brownsville, Tex. Careful investigations have shown that during the mild winter of 1912-13 it did not hibernate north of Florida to any extent. It is obvious that with the expenditure of a comparatively small sum the species may be artificially controlled in Florida during such seasons, as its parasites do not seem to be abundant, and thus such an invasion as occurred during the year 1912 need not be repeated.

The New Mexico range caterpillar.—An appropriation of \$10,000 for the investigation of this insect was made by Congress and included in the agricultural appropriation bill covering the fiscal year 1914. This insect commences operations in late May or early June. As the appropriations were not available, little could be done during the fiscal year. Some assistants, however, were sent to the fields about the time the young caterpillars hatched, but the most important work will have to be done during the spring and early summer of 1914. The European *Calosoma* beetle, now so greatly in evidence in New England as an enemy of the gipsy moth, was sent down to New Mexico and liberated among the young range caterpillars in June. If this species succeeds in establishing itself in this vastly different climatic region, it may prove of great assistance in controlling the pest.

Other cereal and forage crop insects.—In addition to the alfalfa weevil, a number of other alfalfa pests are being studied, among them being a new alfalfa plant-louse, an alfalfa caterpillar, an alfalfa gall midge, and the clover and alfalfa seed Chalcis, as also various cutworms that damage alfalfa.

Other work is being done on the so-called green bug, on the leafhoppers, on the false wireworms, the so-called curlew bug, the chinch bug, the western army cutworm, jointworms, the Hessian fly, white grubs, wireworms, the corn root-aphis, cowpea and soja bean insects, the southern and western corn rootworms, the southern corn leaf-beetle, the western grass-stem sawfly, the clover stem borer, the corn leaf-miner, grasshoppers, and others.

INSECTS INJURING FORESTS.

Dr. A. D. Hopkins is charged with the direction of work for the control of insects injurious to forests.

The Black Hills beetle in the Tongue River Indian Reservation.—The control work against the Black Hills beetle carried on during 1911 and 1912 in cooperation with the Indian Office of the Department of the Interior, in which the Cheyenne Indians did the work of felling and barking infested trees under the immediate instruction of the representatives of the bureau, has, according to recent investigations, resulted in the complete control of this most destructive enemy of the pine forests of that region. It has evidently prevented a repetition of the great losses occasioned by this beetle in the Black Hills of South Dakota. The cost of the operation was less than \$1,000.

The mountain pine beetle.—Control work against the mountain pine beetle in the Glacier National Park, carried on in cooperation with the Interior Department during the past few years, has, according to the developments of the current fiscal year, been successful in protecting timber in some of the most important sections of the park.

The extensive control operations carried on against the same insect in and adjacent to the Whitman National Forest, in cooperation with the Forest Service and private owners, during the fall of 1911 and spring of 1912 has turned out to be successful beyond all expectations. This work was undertaken strictly as a demonstration and forcibly brings out the points that even under unfavorable conditions and the widespread dying of trees from insect attack it is possible and practicable to treat a small part of such an area and successfully to check the spread of the pest and to reduce the loss 80 per cent or more within the treated area.

Work against the same insect at Swan Lake, Mont., in the Swan Lake section of the Flathead National Forest and adjacent State and private lands, in cooperation with the Forest Service, State officials, and private owners, has resulted in the reduction of the infestation from over 30,000 trees in 1912 to about 5,000 in 1913.

The southern pine beetle.—Special examinations of areas where the southern pine beetle was so destructive in 1911 and where control work was carried on by utilizing the infested timber for cordwood, as well as reports from many sections of the South, indicate that the most dangerous insect enemy of the southern pine is completely under

control. It is estimated that this work has saved the South many millions of dollars.

Chestnut insect investigations.—An important result of the investigations of insects in their relation to the chestnut tree bark disease has been the discovery that at least five species of beetles feed on the fruiting pustules of the chestnut tree blight fungus, including the pycnidial, spore-horn, and perithecial stages. The work of these insects has been found in every locality visited where the disease is present. It seems probable that these insects are an important factor in the natural control of the disease.

A careful study has been made of all of the insects which cause wounds in the living tissue of the bark and cambium and thus produce the most important condition for the entrance and establishment of the spores in the living bark. Four species of insects which cause these wounds have been especially studied. These are the chestnut blight beetle, the chestnut bast borer, the chestnut twig gall moth, and the chestnut bark worm.

Experiments with white ants.—Experiments carried on with different species of wood and the treatment of one species of wood with different chemical preservatives to determine the relative immunity against attack and injury by termites have already yielded some important results, indicating that it will be practicable to prevent a large percentage of the losses from white ants in wood set in the ground or used in building and furniture.

INSECTS INJURIOUS TO VEGETABLE AND TRUCK CROPS.

Dr. F. H. Chittenden has direction of the investigation of insects injurious to vegetables and truck crops.

The potato-tuber moth.—This important imported potato pest has been the subject of investigation in southern California and south Texas and is the theme of a Farmers' Bulletin and two press notices of warning on the same topic, which have received favorable comment. Progress has been made in directing potato growers in infested districts, chiefly in the States mentioned, so to handle the fall potato crops as to reduce the loss to a minimum. Warnings of this nature have been distributed broadcast. If the protective and defensive measures recommended are adopted, a very serious reduction in the potato crop of these States will be avoided. There is danger of infestation from neighboring and other States through the use of infested tubers for seed from these States and from foreign countries. Evidence of the importance of this moth may be gathered from the fact that two growers in California estimated their combined losses during 1912 from this pest at \$160,000.

Other potato pests.—Work is constantly being conducted, and with considerable promise, on the Colorado potato beetle with a view to the discovery of improved and cheaper methods of applying more effective and less expensive insecticides than the standards (arsenate of lead and Paris green). Similar work is being conducted, chiefly on Long Island, on the potato flea-beetle, a serious pest in that as well as in other regions. A conservative estimate of the damage resulting from the attacks of these two insects places the loss at 20 per cent of the entire crop.

Onion thrips.—Investigations of the onion thrips, continued along lines instituted in Florida in 1907 and taken up in later years in Colorado, Texas, Indiana, and southern California, were the subject of special attention during the past year, principally in Starke County, Ind., and in the onion-growing regions of southern Texas, and with gratifying results. The advised use of nicotine sulphate and other measures of control are being faithfully carried out by many growers, with the resultant saving of large acreages of onions which might otherwise be lost. A detailed report is in course of completion.

Onion maggots and other onion pests.—These insects have been under observation also for a period of years and progress has been made, especially in regard to methods of planting to avoid attack, a preliminary concise report having been furnished in the Yearbook for 1912.

The cabbage looper.—Much injury has been incurred, on Long Island in particular, as also in neighboring regions and elsewhere, from the ravages of the cabbage looper on cauliflower, cabbage, and related plants. Continuous observations have been conducted during the past two years, and a report will soon be available covering the entire topic.

Other cabbage insects.—Similarly the cabbage aphid, flea-beetles, cabbage worms, and other insect enemies of cabbage, cauliflower, turnip, and the like, have been investigated, and a report on the cabbage aphid will soon be available, demonstrating that this pest is an easy one to control provided the recommendations are carefully carried out.

The spinach aphid.—The spinach aphid, a well-known enemy to spinach and various other crops, can not be controlled by any sprayer as yet tested, when it occurs on spinach. It is the cause of great losses in tidewater Virginia, and an effort is being made to solve the problem of its control by the introduction of beneficial ladybirds. To date this project gives every promise of success.

Miscellaneous truck-crop insects.—In addition to the insects mentioned above, considerable work has been conducted in different stations on insects which are of primary importance locally. Much work has been done and the results published in regard to bean and pea weevils, and especially the broad-bean weevil, a recent importation in California. It is in danger of extending its ravages to other States where broad beans are grown. The results of certain of these investigations have been published. The asparagus insects have been studied in relation to their extending distribution, direct remedies, and possible control by means of a beneficial parasite, a recent discovery. The pickle and melon worms are the subject of much complaint in the southern truck-crop regions, and are being investigated, as are also the insects injurious to relishes, salads, and condiments, such as artichokes, rhubarb, okra, celery, salsify, cresses, lettuce, and parsley. The celery leaf-tyer, a cosmopolitan species, is one of the most important of these pests, and has been the subject of recent investigations, especially in California.

General pests.—A very considerable number of what are termed "general feeders," nearly omnivorous pests, are the cause of great

damage to truck crops and vegetables. Among these the most important are cutworms of many species. Information has been furnished to growers throughout the country in regard to methods of control, and a full report is contemplated. White grubs and wireworms in general are similarly destructive, and work has been done on both classes of insects. Various caterpillars, such as the zebra caterpillar, striped beet caterpillar, and others, the tarnished plant bug, and the false chinch bug are special projects for investigation in different regions. Considerable progress has been made in regard to methods of control for these.

Experiments with insecticides and insecticide machines.—A number of new insecticides, especially those suitable for spraying delicate plants without arsenical injury, have been tested with good results. Among fumigants new substances and methods of application have been devised, and experiments are under way toward reducing the inflammability of carbon bisulphid. Two new types of power sprayers suitable for the application of insecticides to truck crops and for other uses about the farm have been developed, and one of these types has been constructed and is being used in Long Island in an experimental way. The apparatus weighs about 300 pounds, and may be used on an ordinary farm wagon with excellent results. The price at which it may be manufactured is also well within the reach of the average truck grower. Two new contact insecticides for aphides and other sucking insects are being perfected, and considerable progress has been made during the year. One of these has proved very satisfactory on hops, costing about half as much as where nicotine sulphate is used. One of these insecticides was developed in California, the other in Texas.

INVESTIGATIONS OF INSECTS AFFECTING STORED PRODUCTS.

Investigations of insects injurious to stored grains, prepared cereals, flour and meal, dried beans and peas, dried meats, and other food products, also assigned to Dr. F. H. Chittenden and his assistants, have been under careful observation, as in the past. One of the special topics which has been studied carefully is the test of sealed cartons to protect cereals and breakfast foods and dried fruits from insect attack. This is a problem which has engrossed much time and attention, and is being taken up quite generally among producers. The insects affecting dried fruits have also received due attention with regard to sterilization before being packed. Additional experiments in the germination of seeds infested by the broad-bean weevil and the common bean weevil have been undertaken with good results. The use of naphthalene for insects affecting corn and other grains is found successful in Texas, especially against the rice weevil or so-called corn weevil. The fumes are quite effective to the adults, but less so to the immature forms.

TROPICAL AND SUBTROPICAL FRUIT INSECTS.

The direction of the investigations of insects injurious to tropical and subtropical fruits is in the hands of Mr. C. L. Marlatt.

Hydrocyanic-acid gas investigations.—Experiments under the bureau in the use of hydrocyanic-acid gas in fumigating citrus trees

in California during the years 1909 and 1910 resulted in much improved methods, which have since been generally adopted. At the conclusion of the work in 1910 certain problems remained to be completed which could not be undertaken at that time. It has been possible this year to take up this subject again and to work upon these problems, the solution of which will considerably increase the efficiency of the methods of gassing citrus trees and will reduce the cost. The headquarters for this investigation are at Whittier, Cal.

The orange thrips.—This investigation was brought to a conclusion early in 1913, and the laboratory at Lindsay, Cal., was closed. A full report has been prepared for publication.

The citrus white fly.—The investigational side of this project in Florida has been substantially completed. There is now in progress a series of orchard demonstrations conducted in various counties in the State of Florida, in cooperation with growers, to serve as an object lesson of the efficiency of methods of control as developed in the experimental work of the bureau. A circular on spraying has been issued, and other reports are in preparation for publication, including the records of this investigation.

Insects affecting date palms.—The rapid development of the date industry in California, Arizona, and Texas has led to a demand for an investigation of the two principal date scale-insect pests, and a station for this investigation has been established at El Centro, Riverside County, Cal., with branch investigations to be conducted in Arizona and Texas.

Citrus insects in the Louisiana district.—In view of the fact that there is a rather important development of the citrus industry in Louisiana, notably below New Orleans, and of the further fact that New Orleans has been the port of entry for imported citrus fruit from Mexico, Central America, and the West Indies, it is important that the citrus orchards of this region be thoroughly investigated, not only for the benefit of the growers themselves, as leading to better methods of insect control, but also as a means of early detection of any new pests which may have gained a foothold in this region through the port of New Orleans. The assistant formerly in charge of the orange thrips investigation, just completed, has been put in charge of this work with headquarters at New Orleans.

The Mediterranean fruit-fly.—The grave danger of the introduction of this pest from the Hawaiian Islands into California led to a special appropriation by the last Congress of \$35,000 for the investigation. The appropriation became available in August, 1912, and was placed under the charge of the assistant chief of the bureau, Mr. C. L. Marlatt, who visited Hawaii and established at Honolulu a laboratory and a force for the conduct of the local work. The present plan of the investigation is to complete the life-history study of the insect in relation to various host fruits and vegetables, and to cooperate with the Territorial Board of Agriculture in the introduction and establishment of parasitic enemies. Prior to the entrance of the bureau upon the field the Hawaiian board had contracted with Dr. F. Silvestri, of Italy, to make a search in foreign countries for some efficient parasite of the fruit-fly, the expense to

be borne by the Territorial board. Dr. Silvestri found in Africa what he believes to be efficient parasites of the fruit-fly, and was successful in bringing them to Honolulu in May, 1913. They are being cared for and propagated by the Territorial board in cooperation with the Federal experiment station and the field station of this bureau. The third item in the plan of investigation is to effect a local clean-up in the town and vicinity of Honolulu to lessen the danger of the carriage of the insect to the mainland on vessels or in ship's stores, and a fourth item of the plan consists of the inspection and tagging of bananas and pineapples, which are the only fruits permitted to be shipped from Hawaii to the mainland.

There is being carried on also an investigation of fruits imported into the United States from Mediterranean and other countries known to be infested with the fruit fly, as a basis for possible quarantine action. This work is being carried on in cooperation with the Federal Horticultural Board.

INSPECTION WORK.

The work of inspection as done by the Bureau of Entomology, aside from the gipsy moth and brown-tail moth inspection work in New England, consists principally of the examination of the seeds, plants, and fruits imported by the Department of Agriculture and of such commercial importations as are consigned to dealers in Washington direct or in bond. In addition to this, all seeds and plants sent out through congressional distribution, as well as all plants leaving Washington by express and freight, are examined and certified. A considerable number of injurious insects were intercepted in the course of these investigations. Several of these were new to this country and with large possibilities for future damage. The most dangerous single item was a consignment of Irish potatoes imported from a locality in Peru thought to be the original home of these tubers. This shipment was found to be thoroughly infested, and in some cases almost destroyed, by the larva of a coleopterous insect undoubtedly new to this country. This potato pest gave every indication of being perhaps a more serious insect enemy of the potato than any now occurring in this country. This investigation is now being done in cooperation with the Federal Horticultural Board, and as a result of the cooperation much more efficient work will be possible in the future, as better facilities will be afforded. In connection with the inspection and necessary treatment of infested material a good deal of information of value in relation to fumigation and disinfection is being acquired.

WORK IN BEE CULTURE.

Dr. E. F. Phillips is charged with the direction of the work in bee culture.

The wintering of bees.—The principal work of the year is the investigation of the condition of bees during winter. The winter loss is usually considered only as the colonies which actually die, but the weakening in numbers and vitality of practically all colonies is a more serious consideration. Since the life of a bee is determined by the amount of work which it does, it becomes necessary to conserve the energy of the bees, so that they can do the required work in the

spring. The work during the past winter was done at the University of Pennsylvania, where special equipment is available. It consisted chiefly in a study of the responses of bees in heat production to changes in environmental temperature. The bee is unique in that it produces heat by muscular activity to make up for the lack of heat in the outside air. This heat production is according to a definite law, which is being determined.

These observations suggest the desirability of keeping bee cellars at a higher temperature, and during the coming winter this will be tried out. The effects of various foods and their relation to the accumulation of feces, the conservation of the produced heat, the value of hive packing, and the optimum age of bees for winter were likewise investigated in a preliminary way, together with detailed studies of commercial bee cellars.

Activities of bees.—Since manipulations of bees are founded on normal bee activities, studies of this nature have been conducted. Two important papers have been issued during the year, one on the collecting of pollen and the other on the manipulation of wax scales in comb building. Another paper of fundamental importance has been prepared on the organs of smell, which are found to be located in various parts of the body and not on the antennæ, as is usually held. A paper on the temperature of the bee colony during the entire year has been prepared. Work on the structure and function of the dorsal scent gland and on comb building has been conducted.

Diseases of bees.—Work on these diseases has been continued as in former years, and a paper on a disease named sacbrood has been issued. This disease, formerly miscalled "pickled brood," is found to be infectious, and the exciting cause is a filterable virus, which is destroyed by a comparatively small amount of heat. The examination of samples of diseased brood has been continued, and additional data concerning the geographical distribution of the diseases has been obtained.

Beekeeping in Porto Rico.—A survey of the resources of this island for the beekeeper was made during the year, and the opportunities for the future growth of the industry are splendid. A report on the sources of honey and the special problems before the beekeepers of the island is in preparation. Steps have already been taken by the insular government to prevent the introduction of bee diseases and to develop the industry.

Cooperative work.—Cooperative work on the conditions of the beekeeping industry in Wisconsin has been continued, while similar work in Pennsylvania has been discontinued. A new set of grading rules for comb honey were drafted and adopted by the National Beekeepers' Association. These obviate the chief difficulties which have been experienced in marketing this product.

REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF BIOLOGICAL SURVEY,
Washington, D. C., September 15, 1913.

SIR: I have the honor to submit herewith a report on the work of the Biological Survey for the fiscal year ended June 30, 1913.

Respectfully,

HENRY W. HENSHAW,
Chief, Biological Survey.

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

WORK OF THE BIOLOGICAL SURVEY.

The work of the Bureau of Biological Survey as usual was conducted along three lines: (1) Investigations of the food habits of North American birds and mammals in relation to agriculture, in charge of Dr. A. K. Fisher; (2) biological investigations with special reference to the geographic distribution of native animals and plants, in charge of E. W. Nelson; (3) supervision of national bird and mammal reservations, the preservation of game, and the enforcement of the Lacey Act, in charge of Dr. T. S. Palmer.

PRAIRIE DOGS IN THE NATIONAL FORESTS.

Attempts to eliminate prairie dogs from the national forests were continued in Pike and Cochetopa Forests of Colorado, and in the Coconino Forest of Arizona, and 30 tons of poisoned grain were used in the work. A party will endeavor to complete the work in the Cochetopa National Forest, where since last September 85 per cent of the prairie dogs were killed from 278,000 acres. Among the important results expected to follow the destruction of prairie dogs in the areas in question are:

1. Prevention of the extensive erosion of the soil in many localities where the grass has been literally eaten out by the roots by the rodents.

2. A material increase of profit to the Government from the issuance of grazing permits in consequence of a substantial increase of forage.

Prairie dogs are most economically killed by the use of poison, but in certain restricted areas carbon bisulphid has proved an effective aid in completing the work of extermination. The extensive use of the gas, however, is not recommended, since it kills the small predaceous mammals which enter the burrows for the purpose of feeding on the rodents. After approximately 85 per cent of the prairie dogs have been killed by poison it is believed that predaceous

mammals, together with birds of prey, will prevent material increase in their number, and so render unnecessary the work of complete extermination, which relatively is very costly. The cost of exterminating prairie dogs by means of poisoned grain, including the labor, is about 5 cents per acre under average conditions, and with bisulphid from three to five times that amount.

DESTRUCTION OF GROUND SQUIRRELS IN THE NATIONAL FORESTS.

The work of destroying ground squirrels in the national forests is doubly important in view of the fact that ground squirrels not only inflict great damage upon forage and crops, but in California have been found to be infected with the plague.

A reconnoissance for the purpose of finding where ground squirrels were most numerous was made in the following national forests of California: Stanislaus, Tahoe, Sierra, Sequoia, Kern, Monterey, and Santa Barbara, but the aggressive campaign against the rodents was carried on chiefly in the four last-named forests, since these were the only ones near the plague-infested region in which ground squirrels were found to be very abundant.

Poisoning was found the most efficient and economical method of exterminating ground squirrels. The average cost, as determined by work in the Santa Barbara Forest, was slightly more than 3 cents per acre. Carbon bisulphid, while very efficient, costs about 10 times as much.

SEED-EATING RODENTS IN THE NATIONAL FORESTS.

The Forest Service is engaged in reforesting considerable tracts of the national domain which have been deforested by excessive lumbering or by forest fires. This important work has been seriously hampered and the cost greatly increased by the destruction of the seeds by small rodents after planting.

Investigations of the problem of freeing the seeded areas in the national forests from these destructive rodents were continued during the early part of the year in the Snòqualmie and Olympic National Forests in Washington and the St. Joe and Coeur d'Alene National Forests in Idaho. Chipmunks, white-footed mice, and pine squirrels were found to be the principal culprits, and experiments in poisoning them confirmed the results published by the Biological Survey in its circular No. 78. It has been found to be comparatively easy and economical to extirpate these small rodents on seeded areas, and the directions have been formulated so that the work can be done successfully by nonexperts.

ECONOMIC STATUS OF THE MOLE.

In spite of the fact that under natural conditions moles are insectivorous and almost exclusively beneficial, complaints are constantly received of their undesirable activities in flower beds, lawns, golf links, and similar places where smoothness and sightliness of the turf are desirable. It has been necessary, therefore, to devise methods of destroying moles under these special conditions. On account of the nature of their food, which consists chiefly of insects, it is impracticable to kill them with poisoned baits. Trapping is

effective, particularly when the operator knows the habits of the animals. The trap devised in the Biological Survey and patented for the benefit of the public was further tested and found very efficient. Although the fur of American moles is of good quality and in considerable demand, the prices are too low to induce any considerable number of American citizens to become mole catchers. It is possible that when the efficiency and use of the better makes of traps are more widely understood the farmer's boy may be tempted to add to his supply of pocket money by trapping moles.

FUR FARMING.

During the year progress has been made in experiments in the breeding of fur bearers, especially minks. A location for the purpose was secured near Prichard, Idaho, in the Coeur d'Alene National Forest, where necessary buildings and cages have been built, and an experienced man is now in charge. A stock of adult minks was assembled, and the results of the first year's breeding is awaited with interest. In cooperation with the National Zoological Park, Washington, D. C., an experiment in the breeding of minks is under way. A number of adult minks have been caged, and an attempt will be made to breed them for size, quality of fur, and disposition.

DEMONSTRATIONS FOR THE CONTROL OF CRAWFISH IN MISSISSIPPI.

During the fiscal year 1912-13 experiments were made in the Houston Clay formation near Muldon, Miss., to devise economical methods for the control of crawfish. Though small and apparently insignificant, these crustaceans are so numerous in the black prairie soil that they destroy great quantities of forage and produce and seriously interfere with the development of cotton and corn throughout the area they infest. The experimental plot, containing about 75 acres, was purposely chosen from pasture land where the infestation was great, an average of 10,000 crawfish holes being found to the acre. Under the old method of catching the animals by hand at night the cost varied from \$6 to \$10 per acre. By the use of carbon bisulphid, according to the method devised by the Biological Survey, these pests can be practically exterminated at an expenditure of from \$1.75 to \$2.50 per acre.

DESTRUCTION OF THE ALFALFA WEEVIL BY BIRDS.

The alfalfa weevil, a dangerous enemy to the alfalfa industry, has become strongly entrenched in Utah and is now invading contiguous States. The knowledge, therefore, of the extent to which birds and mammals can be relied upon to check the spread of the pest becomes important. Much field work on the relation of vertebrates to the weevil, in Utah, was done during the spring and summer of 1912. Examination of the stomachs of birds frequenting the infested region shows that 41 species feed to a greater or less extent upon this beetle, and several species are exceedingly active in destroying it. Noteworthy among these is Brewer's blackbird. Upward of 100 of the insects are not uncommonly found in a single stomach,

and one individual had devoured 542. In the early spring, meadow larks and magpies render valuable aid by feeding extensively on the adult insects, which at this time emerge from hibernation, while a little later the good work is continued by robins, vesper sparrows, Brewer's sparrows, red-winged blackbirds, and killdeers, all of which species frequent infested fields. Quail, introduced into Utah from California, are fairly numerous over much of the infested area and eat many insects. One female was found to have eaten 141 larvæ. The fact that the larval period of the weevil is at its height when many birds have nestlings to feed makes the pest a staple article of diet. Thus it was found that about one-third of the food of nestlings of the English sparrow consisted of alfalfa weevils, and where alfalfa fields were readily accessible, young sparrows were fed almost exclusively upon weevils. However bad its record elsewhere, the English sparrow must be credited in Utah with doing good work for the farmer. The young of Brewer's sparrow and the yellow-headed blackbird, and even nestling magpies, are fed many weevils. Though it is impossible to express in figures the actual good done by the birds of this region in reducing the numbers and checking the spread of the weevil there can be no doubt that they render important service.

RELATION OF BIRDS TO THE BOLL WEEVIL.

Investigation of the relation of birds to the boll weevil in newly infested territory in Alabama and Mississippi was carried on during the entire growing season. It was learned that birds in newly invaded territory quickly learn to find and feed upon this pest. Upward of 50 species are known to destroy the boll weevil. The swallows in these States gave marked evidence of their ability to find and devour large numbers of boll weevils.

INDEX OF ECONOMIC ORNITHOLOGY.

A much-needed index to the papers relating to the food of birds published by the Biological Survey has been issued. No fewer than 131 publications relating to economic ornithology have been prepared by members of the bureau and published by the department during the years 1885 to 1911, inclusive. The index renders possible ready reference to everything the bureau has published on the food of the native birds. The total number of native birds which have been reported upon is 401; of foreign and introduced species, 59.

FOOD OF WILD FOWL.

A large number of stomachs of wild ducks were examined to determine the exact nature of their food. A trip was made to Avoyelles Parish, central Louisiana, to study the peculiar association of wild-duck foods growing there. As a result numerous seeds and other vegetable products which had hitherto baffled identification were traced to their mother plants. Studies of the food of ducks collected in this parish show how subject to local conditions is the dietary of wild fowl. Three of the most important food plants of ducks in Avoyelles Parish, which supply fully two-thirds of their food, are not known to be important in any other locality.

WORK IN THE ISLAND OF PORTO RICO.

Investigation of the birds of Porto Rico, undertaken last year at the request of and in cooperation with the board of commissioners of agriculture of that island, has been completed, the work having been carried on by an assistant of the bureau in all of the agricultural districts of the island. Extended field observations on the general habits of the island birds were made, and a sufficient number of stomachs were collected to give definite data as to the exact nature of the food of the several species. The examination of the material collected is being pushed as rapidly as possible, and a report on the subject will follow in due time.

Though the investigations were confined chiefly to cultivated districts, effort was made to study certain of the rarer forest-loving species that their economic relations might be understood. It is interesting to note that the herons of the island, which have suffered greatly at the hands of sportsmen and plume hunters, are of great value to the agriculturist. The killdeer also was found to be a very useful insect eater. The most serious insect pests of the island were ascertained to be the "changa," or mole cricket, and the May beetle, which make up a large part of the bill of fare of several abundant species of insectivorous birds.

For a subtropical region Porto Rico is strangely deficient in the number of species of birds, even when compared with the islands of the greater Antilles. The small number of individuals of certain varieties is no doubt due chiefly to the extensive deforestation that has taken place for agricultural purposes, the island having been extensively cultivated and rather densely populated for many years. Although no indigenous bird of economic importance has been actually exterminated, many species have been greatly reduced in numbers, especially the ground-frequenting kinds, which have suffered greatly by the introduction of the mongoose.

BIOLOGICAL INVESTIGATIONS.

The work of this section in investigating the distribution, migration, and habits of North American birds and mammals has been limited during the present year by lack of funds. Field work has been continued on a small scale in areas already under investigation, including Alabama, Arizona, California, Idaho, and North Dakota.

The usefulness of the biological surveys of the States is rapidly increasing through a widespread public interest in the conservation of the native birds and mammals. By means of these surveys the species inhabiting the several States are determined and their status as permanent residents or migrants made plain. Such surveys also determine the past and present distribution of the game birds and mammals. They thus afford the basis for regulations for protecting the species, especially the game birds and mammals, and show those best adapted for introduction into other areas. The biological surveys of California and Alabama are well advanced toward completion. In Arizona, North Dakota, and Idaho the work is about half done.

It has been impossible to complete the small amount of field work necessary to finish the survey of Wyoming. The final report on the

survey of New Mexico was sent to press at the end of the fiscal year, and the report on the biological survey of Lower California was completed for publication. The report on the birds of Texas is approaching completion, and that on the birds of Alabama is in an advanced state of preparation.

Many inquiries concerning the identity and distribution of birds and mammals have been received during the year from State institutions, farmers, and others, and more than 600 specimens of birds and a large number of mammals have been sent to this bureau for identification in this connection. In addition, State and county officials, notably in Wisconsin and Colorado, have requested the identification of scalps of wild animals submitted for bounties. This has resulted in preventing gross frauds under State bounty laws.

BIRD MIGRATION.

Reports have been received during the year from about 200 volunteer bird-migration observers throughout the United States and Canada. About 50,000 cards containing notes on birds, mainly referring to migration, were added to the office files. After the migratory-bird bill was passed, on March 4, 1913, reports on the migration of water fowl were obtained by correspondence from about 175 persons for use in connection with formulating regulations under this law.

From these reports and the mass of information already on file migration maps were prepared of each of the migratory game birds, and these served as the basis of the closed seasons finally recommended.

COOPERATION.

More requests for cooperation with State organizations in the biological surveys of States have been received than the funds will permit us to take up.

During the summer of 1912 Mr. F. K. Vreeland and Mr. W. F. Patterson volunteered to cooperate, mainly at their own expense, in working out the ranges of large game animals in northern British Columbia and secured for this bureau many specimens and much information from that region. In the fall Mr. Charles Sheldon joined E. W. Nelson in northern Arizona and at his own expense did an extremely useful piece of work in determining the abundance and distribution of the mountain sheep along the Grand Canyon of the Colorado.

IMPORTATION OF MAMMALS AND BIRDS.

Constant vigilance is necessary to prevent the introduction into the country of pests whose ravages will cause losses running into the millions. None of the birds and mammals whose importation is specifically prohibited by law, as English sparrows, starlings, monogeoses, and flying foxes or fruit bats, were offered for entry during the year, nor has careful inquiry revealed the surreptitious entry of any of these pests. Under the general authority conferred on the Secretary of Agriculture, entry was denied three consignments: (1) Twenty-four cardinals, from Tampico, Mexico, which were returned

at the expense of the shipper because of laws prohibiting the keeping of cardinals in captivity; (2) 25 hares, from New Zealand, intended for acclimatization; (3) 4 Java sparrows refused admission at Honolulu because of their destructive tendencies in rice fields.

During the year a great decline was noted in the importation of live pheasants from Canada, the decrease in the number of permits issued being from 130 in 1911 to 35 in 1912. Further evidence of the decline appears from the fact that the total number of pheasants imported during the year, including those brought from Europe, was only 9,417, as against 15,412 imported last year. A large increase in the importation of pheasant eggs, mainly from England, partly explains the decrease. The results obtained by raising pheasants from imported eggs instead of imported breeding stock will be carefully noted.

A decrease was noted also in the importation of European partridges, of which 10,283 were imported this year, as compared with 23,181 last year. The principal cause of this decline seems to be a lowered estimate of the partridge as a desirable introduction. A decrease from 7,751 to 2,936 of Mexican quail imported is due partly to the latter cause and partly to increased restrictions on importing these southern-reared birds into the United States for stocking northern covers, for which they are unfit.

The importation records for the year show a great increase in the number of guinea pigs brought from England for laboratory experiments. There were 12,112 of these little animals imported, as against 1,471 last year.

Special interest attaches to a consignment of birds for the New York Zoological Park entered on December 26, 1912, which contained such rare species as 2 Count Raggi's birds of paradise, 1 spotted bower bird, 2 lammergeyers, 3 Goliath herons, and 6 purple sunbirds. Among the rare and interesting mammals imported were a binturong, 2 pandas, and 5 Tasmanian devils.

The transactions of the year involved the issuance of 491 permits and the entry of 477,364 birds and 17,272 mammals, as against last year's issue of 583 permits and the entry of 457,077 birds and 5,457 mammals. Inspections at New York, Philadelphia, and San Francisco, where all but an insignificant portion of the entries are made, numbered 179, as compared with 140 in 1912. The birds comprised 451,899 nongame birds (392,422 canaries and 59,477 miscellaneous birds) and 25,465 game birds (9,417 pheasants, 10,283 partridges, 2,936 quail, and 2,829 miscellaneous game birds). Of the entries of the year the following were admitted under permit: 368,112 canaries, 55,301 miscellaneous nongame birds, 9,327 pheasants, 10,283 partridges, 2,936 quail, 2,641 miscellaneous game birds, and 16,363 mammals, while no permits were required for the entry of 24,310 canaries, 4,176 miscellaneous nongame birds, 90 pheasants, 188 miscellaneous game birds, and 909 mammals.

At Honolulu 52 permits were issued authorizing the entry of 1,101 nongame birds (of which 1,045 were parrots), 142 game birds, and 3 mammals (monkeys). The game birds comprised 133 versicolor, Soemmerring, and ringnecked pheasants for stocking covers on Oahu, and 9 black swans.

For convenient comparison the importations under permit of the past six years are shown in the following table:

TABLE I.—*Importations of birds and mammals during the years 1908-1913, inclusive.*

Year.	Permits.	Canaries.	Pheasants.	Partridges.	Quail.	Other game birds.	Miscellaneous birds.	Mammals.	Total.
1908.....	460	325,285	4,415	7,781	724	9,533	47,487	1,958	395,520
1909.....	416	338,256	2,996	29,895	868	2,009	41,414	2,203	429,980
1910.....	519	361,054	7,200	18,931	1,933	2,481	48,778	6,660	458,401
1911.....	519	354,858	13,399	39,981	3,753	2,340	64,338	5,427	480,691
1912.....	583	362,604	15,412	23,181	7,751	3,742	44,387	5,457	462,534
1913.....	491	392,422	9,417	10,283	2,936	2,829	59,477	17,272	494,636

This table sets forth clearly the rise and decline of pheasant and partridge importations. It also shows a great increase in the importations of mammals in the past four years, especially in 1913, due to the large number of monkeys, guinea pigs, and mice brought in for experimental purposes. As the import duty on these animals was 20 per cent ad valorem (reduced to 10 per cent ad valorem by the new tariff law), it would seem that the needed supply of guinea pigs and mice might be profitably bred in the United States. The decrease in the number of nongame birds imported in 1912 was due chiefly to the cessation of the importation of Mexican parrots, of which several thousand were annually brought in at Eagle Pass, Tex., and New Orleans, and a new Australian law prohibiting export of many birds previously exported freely.

NATIONAL BIRD RESERVATIONS.

During the past year seven new national bird reservations were established by Executive order, making a total of 63 to date. The new ones are as follows: Chamisso Island, in Alaska; Pishkun, in Montana; Desecheo Island, in Porto Rico; Gravel Island, on Green Bay in Wisconsin; Aleutian Islands, in Alaska; Walker Lake, in Arkansas; and Petit Bois Island, in Alabama. These new reservations are important breeding sites for certain species of wild birds. A brief description is appended herewith:

ALEUTIAN ISLANDS, ALASKA.—This reservation embraces the islands of the Aleutian chain situated between the north Pacific Ocean and Bering Sea. These were set apart not only as a preserve and breeding ground for native birds but for the propagation of reindeer and fur-bearing animals, and for the encouragement and development of the fisheries.

CHAMISSO ISLAND, ALASKA.—This reservation, situated 2 miles south of the Choris Peninsula, is a mile and a quarter in length and half a mile in breadth. It is one of the important breeding rookeries on the northwest coast of Alaska. Among the birds that resort to it are horned puffins, Pallas's murre, Pacific kittiwakes, and the Point Barrow gull.

PISHKUN, MONTANA.—This reserve is about 8 miles from the Willow Creek Reservation and consists of two ponds surrounded by a

heavy growth of long grass about the shore, making an attractive nesting place for ducks during the summer. The Reclamation Service proposes to withdraw these sites for reservoir purposes, which, when completed, will leave several large islands in the lake offering ideal breeding grounds.

PETIT BOIS ISLAND, ALA.—This reservation, situated in the Gulf of Mexico off the southern coast of Alabama, is adapted as a breeding place for certain sea birds. The island is uninhabited, the middle portion consisting of a series of open grassy flats, marshes, small ponds, and rolling sand hills, supporting a dense growth of timber, chiefly pines. The birds frequenting the reservation are laughing gulls, brown pelicans, black skimmers, least terns, royal terns, Louisiana herons, and black-crowned herons.

DESECHEO ISLAND, P. R.—This is a volcanic island in the Mono passage about a mile and a half long by a mile wide. It is densely covered with vegetation, the West Indian birch predominating, with large areas of four species of cactus and many shrubs. There is no water on the island. Few land birds inhabit the island, but over 15,000 sea birds of different species resort to it, consisting of boobies (between 8,000 and 10,000), red-footed boobies, man-o'-war birds, noddies, bridled terns, and laughing gulls.

The four reservation inspectors have rendered valuable services in instructing wardens, together with other work requiring a general knowledge of birds and mammals. During the past year wardens have been secured for the more important periods of the year for the Deer Flat Reservation, Idaho; Three Arch Rocks and Cold Springs, Oreg.; Quillayute Needles, Copalis Rock, and Flattery Rocks, Wash.; Tortugas Keys, Fla.; Walker Lake, Ark.; and Petit Bois Island, Ala. Regular warden service is maintained at the following reservations: Key West, Pelican Island, Pine Island, Mosquito Inlet, Indian Key, Passage Key, and Palma Sola, Fla.; Breton Island, La.; Loch Katrine, Wyo.; Lake Malheur and Klamath Lake, Oreg.; Chase Lake and Stump Lake, N. Dak.; Minidoka, Idaho; Niobrara, Nebr., and Saint Lazarus Island, Alaska. A special agent of the bureau is detailed each spring during the fishing season to look after matters on the Forrester Island Reservation, in Alaska, to prevent disturbance of the breeding birds.

Permits to trap on Lake Malheur and Klamath Lake Reservations were issued during the winter, and the reports show a notable decrease in the number of fur-bearing animals taken, the principal reason being deep snows and the severe cold weather prevalent during the months of December, January, and February. On Klamath Lake very little trapping was done, chiefly because a portion of the lake was reserved which had previously been overtrapped. On Klamath Lake the following fur bearers were taken: 26 mink, 2 skunks, 12 weasels, and 2 raccoons. On Lake Malheur 20 mink, 2,475 muskrats, 7 coyotes, 5 raccoons, and 1 weasel were trapped.

All of the reservations are in good condition, and the birds are increasing in numbers each season, proving that the object of the establishment of the reservations is being attained.

A severe storm visited Pelican Island and Mosquito Inlet Reservations, in Florida, beginning February 13 and continuing three days, with the effect that nearly all the birds of the first nesting on Pelican

Island were destroyed. Not to be discouraged, the parent birds returned to their island home as soon as conditions permitted and again nested, this time successfully.

An unusually early spring brought a number of waterfowl to the Lake Malheur Reservation, in Oregon, a month earlier than usual. Arriving before the ponds were free from ice, the ducks and geese became weak from lack of food and were unable to continue their migration. The warden, discovering the condition of the birds, purchased grain and fed them until they were able to leave.

The following brief information is given concerning some of the more important reservations:

BRETON ISLAND, LA.—A steady increase is reported in nearly all of the species of birds inhabiting the different keys, an increase of 5,000 laughing gulls alone being reported.

FORRESTER ISLAND, ALASKA.—A noticeable improvement was observed by the warden in the use of this reservation as a nesting and breeding place for wild fowl. The stationing of a warden on this reservation part of the year is necessary on account of the salmon-fishing industry carried on by natives and others, 432 permits being issued by the warden, cooperating with the Bureau of Fisheries, for the season of 1913, as against 291 in 1912.

LAKE MALHEUR, OREG.—The increased amount of water in the lake has greatly improved conditions. During the equinoctial storm in March many bluebirds perished. A few species of birds remained at the reservation during the entire winter.

MOSQUITO INLET, FLA.—This is one of the most important and interesting havens of refuge for water birds in the South, as well as a nesting and breeding place. A large increase of birds is reported on the inlet during the past year. It is important to note that the warden in charge reports an increase in numbers of the American egret during the months of November and December. The severe northeast storm visiting this reservation during the week ending January 14 destroyed a number of young least terns and washed away many eggs. The colony of these birds, however, is increasing each year.

TORTUGAS KEYS, FLA.—This is another important bird reservation inhabited mostly by sooty and noddy terns, approximately 47,000 of the former birds having been noted on the island at one time last fall. The small number of noddy terns is partially accounted for by the destructive hurricane of 1910, which washed away the entire western side of the island.

PELICAN ISLAND, FLA.—Heretofore the pelicans have usually nested twice—the first time in September and the second in April. This year, however, the birds showed no intention of nesting the second time.

EXPEDITION TO LAYSAN ISLAND.

An expedition to the Hawaiian bird reservation was made, the party being under the direction of Commodore G. R. Salisbury, United States Navy, retired. The party of four left Honolulu on the U. S. revenue cutter *Thetis* December 15, and returned March 22.

This is the first time these Pacific bird colonies have been visited in winter. During the trip five of the islands comprising the reservations were inspected by the party, and a landing was made on four of them.

Rabbits were imported into Laysan several years ago, and they have multiplied to such an extent as to threaten the existence of the island vegetation. As a dearth of vegetation would jeopardize the bird colonies, which require shade, especially during the nesting season, the destruction of rabbits was made one of the main objects of the expedition, and the party succeeded in killing 5,000, or about one-half of the total colony.

A number of young coconuts were planted on Laysan, and the result of this experiment to secure a growth of trees on this almost treeless island will be watched with interest. Excellent specimens of the rare Hawaiian seal were secured from Laysan and Laysian Islands, where they breed.

The colonies of birds nesting on Laysan and other islands of the reservation were found to be prospering, and no evidence was obtained that any of the islands have been visited by poachers since 1909.

NATIONAL BISON RANGE.

An addition of 14 calves to the herd of buffalo on the national bison range during the past year brings the total number to date to 96. Of the 82 adult animals 45 are females and 37 males. The animals are in excellent condition. The 11 head of elk on this range were increased by the birth of 4 calves, and 9 calves were brought to the range on March 11 from the Jackson Hole country. The 5 head of antelope have been increased by the birth of 4 calves. Both elk and antelope are doing finely.

FEEDING AND TRANSPORTING ELK.

On account of the unusually mild winter weather which prevailed in the Jackson Hole region of Wyoming, it was not necessary to feed the elk so extensively as during the previous winter. From the middle of February till April 21, 500 tons of hay were fed to about 4,000 elk. The loss of elk on the feeding grounds was very small.

One hundred head of elk were captured in Jackson Hole and transported over the Teton Pass to Driggs, Idaho, where they were shipped to several States. The first shipment was made on March 3, when 25 head left for Salt Lake City, to be liberated in the national forests in Utah. On the same day 15 head were started for Billy Meadows, in Oregon. On the following day 10 head were shipped to the Montana National Bison Range; 25 head to Hermosa Creek, in the Durango Forest, Colo.; and 25 head to Hunter Creek, in the Sopris Forest, Colo. These transfers were made with the loss of but 7 head, resulting probably, in most cases, from injuries received in the corral during capture.

Another lot of 100 elk was transferred from the Yellowstone National Park, being loaded and shipped at Gardiner, Mont., under the supervision of an agent of this bureau, March 4. These were consigned as follows: Twenty-five head to the national forests in Col-

orado; 25 head to the Sundance National Forest, in South Dakota; 25 head to the State game commissioner of Utah, for the State national forests; and 25 head to Walla Walla, Wash.

A fair increase is reported in the number of elk wintering in the Jackson Hole country last winter, with but slight loss (less than 100) from the usual winter casualties. According to the census made by this bureau in cooperation with the Forest Service, the total number was placed at 19,829, an increase of about 3,000 over last year.

According to the census made by the superintendent of the Yellowstone National Park, there were 28,729 inside the park belonging to the northern herd and 3,500 outside, or a total of 32,229. During the winter 538 elk were shipped from Gardiner to other ranges, and 200 by the Montana State authorities, which, added to the above total, reaches 32,967, an increase of 2,866 over 1912. Only about 340 were found dead—mostly yearlings. An estimate of the total number of elk in the Jackson Hole country and in the Yellowstone National Park is about 52,800, an apparent increase of 10 per cent. All the elk are reported to be in excellent condition.

ANTELOPE IN WYOMING.

A thorough investigation of the number and condition of antelope in the State of Wyoming by an agent of the bureau last winter established the fact that there are only about 6,000 head in the entire State, while only a few years ago this number was exceeded in one county alone. The alarming decrease of this animal is to be explained by unusually severe winters, illegal killing, predatory animals, and lack of food as a consequence of the number of sheep pastured in the region. The antelope are now confined to 9 counties, as follows: Albany, Laramie, Carbon, Sheridan, Johnson, Weston, Converse, Uinta, and Fremont, the largest number being in the last four named counties.

NIORRARA BIG GAME RESERVE.

In the early part of the year 1912 Mr. J. W. Gilbert, the owner of a small big-game park at Friend, Nebr., generously offered his herd of buffalo, elk, and deer to the Government for preservation on national territory within the State of Nebraska. The lack of suitable quarters caused some delay in accepting the offer, but on November 14 of that year an Executive order was issued setting aside as a game preserve a tract of land additional to the Niobrara bird reservation, near Valentine, Nebr. The herd was then officially accepted by the Secretary of Agriculture, and preparations begun for establishing it on this very favorable location.

Through the cooperation of the National Association of Audubon Societies and the citizens of Valentine, Nebr., an inclosure was provided, at a total expense of \$1,700. Some of the buildings remaining on the old Fort Niobrara Military Reservation were utilized as headquarters, and a warden was appointed on December 16, 1912.

The herd, consisting of 6 buffaloes, 17 elk, and 2 deer, was conveyed by railroad from Friend to Valentine about the middle of January, 1913. The land comprising this reserve offers a varied surface of low hills and table-land, interspersed with small groves

of pine and oak trees, affording range and shelter which could hardly be surpassed. The animals soon adapted themselves to the new location and are now thriving. Instructions have been given to the warden to afford citizens of the State every facility for viewing the herd, and on public-school holidays the bureau's agents have given instructive talks to the scholars and visitors. Frequently over 100 visitors a day have viewed the herd.

INFORMATION CONCERNING GAME.

The index to game legislation in the United States has been completed. Memoranda to the index of the more important laws have been prepared for all the States except Virginia, Washington, and Wyoming.

The usual annual game publications were issued, including the Directory of Game Officials and Summary of the Game Laws for 1912, beside three sets of small "ready-reference" card maps, containing matter of special interest to State game departments and others interested in game conservation.

INTERSTATE COMMERCE IN GAME.

ENFORCEMENT.—During the past two years the bureau has given particular attention to the enforcement of sections 242, 243, and 244 of the criminal code relating to the interstate traffic in game. With the limited force available it seemed best to concentrate efforts within a few States where violations are most numerous. The many convictions secured in the territory covered and the publicity given the Federal prosecutions have already materially lessened illegal shipments.

State authorities have given the bureau every assistance possible in this work, and wherever evidence has been gathered by this bureau, showing violations that can be prosecuted under the statutes of the State, the data have been turned over to the State game-warden department upon request.

PROSECUTIONS.—Ninety-two cases have been closed, convictions following in every instance. Fines amounting to \$4,712 were assessed and paid; 22,915 quail (*Colinus virginianus*) and 972 ruffed grouse (*Bonasa umbellus*) were involved in these shipments. The number of prosecutions disposed of by the bureau are given by States: District of Columbia, 2; Kentucky, 17; Maryland, 1; Michigan, 8; Missouri, 1; North Carolina, 9; North Dakota, 1; Ohio, 1; Pennsylvania, 2; Virginia, 46; West Virginia, 2; Wisconsin, 2.

PENDING CASES.—In addition to the cases disposed of during the year, there are now pending 125 cases, as follows: Virginia, 17; North Carolina, 20; Tennessee, 21; West Virginia, 9; Kentucky, 12; Massachusetts, 1; Pennsylvania, 10; Minnesota, 10; Michigan, 7; Missouri, 2; New Hampshire, 1; New Jersey, 3; Maryland, 1; Wisconsin, 7; Ohio, 2; North Dakota, 1; Illinois, 1.

INVESTIGATIONS.—This bureau now has under investigation nearly 1,000 cases involving the interstate shipment of game, the number of quail and ruffed grouse in these shipments being more than 100,000.

COOPERATION IN GAME PROTECTION.

During the year the Biological Survey cooperated with a number of organizations and State officials and has received assistance in connection with its work of protecting big game and game birds in various parts of the country:

With the Forest Service in establishing herds of elk on national forests in Utah, Colorado, and South Dakota, and in collecting information regarding the condition of big game in Colorado and Wyoming.

With the Department of the Interior in ascertaining the condition of big game in the Yellowstone National Park and in shipping elk from the park to national forests.

With the Treasury Department in regulating the importation of foreign birds and mammals and in dispatching the expedition to Laysan, the Hawaiian bird reservation in the mid-Pacific.

With the American Bison Society in the establishment of the proposed national game preserve in the Wind Cave National Park, in South Dakota.

With the National Association of Audubon Societies in patrolling bird reservations, especially in Florida, Louisiana, Michigan, and Alaska; and in a study of the birds on the St. Lazaria Reservation during the summer of 1912; with the Bureau of Fisheries in a study of the food habits of the fish-eating birds on the Forrester Island Bird Reservation, Alaska, in the spring of 1913; and with the citizens of Valentine, Nebr., in stocking the Niobrara Reservation with a herd of buffalo, elk, and deer.

Through cooperation with the State warden of Oregon the herd of elk on the Wallowa Forest Reserve has been cared for during the year; a census of the big game of Oregon obtained, assistance rendered in the protection of birds on the Malheur, Klamath, Cold Springs, and Three Arch Rocks Reservations, and quarters furnished in Portland for the bureau district inspector.

With the Civil Service Commission and State game warden of Wisconsin a plan was devised and experimental work conducted in developing a system of promotion examinations for deputy game wardens in the effort to raise the standard of the warden service in the various States.

REPORT OF THE CHIEF OF THE DIVISION OF ACCOUNTS AND DISBURSEMENTS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ACCOUNTS AND DISBURSEMENTS,
Washington, D. C., September 10, 1913.

SIR: I have the honor to submit herewith a report of the work of the Division of Accounts and Disbursements for the fiscal year ended June 30, 1913.

Very respectfully,

A. ZAPPONE,
Chief of Division.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

CHARACTER OF WORK.

The chief of the division and disbursing clerk is charged by the Secretary of Agriculture with the duty of preparing all requisitions for the advance of public funds from the appropriations for the Department of Agriculture to disbursing clerks and special disbursing agents charged with the disbursement of public funds; the keeping of appropriations ledgers relating to the advance and disbursement of all items of appropriations; the payment of all vouchers and accounts submitted from the various offices, bureaus, and services of the department; prepares for Congress the annual report of expenditures; and performs such other duties as may be prescribed by the Secretary.

WORK OF THE YEAR.

APPROPRIATIONS, EXPENDITURES, ETC.

The total appropriations for the department for the year ended June 30, 1913, amounted to \$24,735,135.80. Of this sum (\$24,735,135.80), \$18,301,453.09 was disbursed prior to the close of the year, leaving a balance of \$6,433,682.71, nearly all of which is covered by outstanding liabilities. Supplemental accounts for the year 1912 were also paid, amounting to \$1,201,493.52. The unexpended balances for the year 1911, amounting to \$464,249.17, were finally covered into the Treasury on June 30, 1913.

There were received, audited, and paid 75,163 accounts, amounting to \$15,508,044.53 (not including Forest Service). In payment of these accounts 137,647 checks were drawn on the Treasury at Washington and the Subtreasuries at New York and at Chicago.

There were also audited and sent to the Treasury Department for payment 1,866 accounts.

LOST CHECKS.

During the year 71 checks were lost in transit through the mails or by the payees.

REQUISITIONS, LETTERS, AND REQUESTS.

Eighty-five requisitions for public funds were drawn on the Treasury, aggregating \$13,397,097.70. (This does not include Forest Service.)

The number of letters of authorization for travel was 9,415.

The number of letters written and received in the ordinary transaction of business was about 120,000.

The number of requests for passenger transportation was 39,733.

The number of requests on the Quartermaster General for the transportation of Government property was 9.

The number of departmental bills of lading issued was 5,983.

TEMPORARY SPECIAL DISBURSING AGENTS.

Twenty-seven temporary special disbursing agents and seven district fiscal agents were active during the year, and the sum of \$5,448,910.19 from the appropriations of the department was advanced to them, requiring the issuance of 182 requisitions upon the Treasury. The total number of temporary special disbursing agents and district fiscal agents shown includes 4 and 7, respectively, for Forest Service, to whom \$5,246,623.21 was advanced, requiring 98 requisitions upon the Treasury. All accounts of temporary special disbursing agents and district fiscal agents of the department were given an administrative examination in this division before being forwarded to the Treasury Department for final audit and settlement.

MILEAGE BOOKS.

During the fiscal year 2,261 mileage and scrip books were purchased for official use by employees of this department, at a cost of \$61,138. Rebates on these books, amounting to \$3,986.19, were deposited in the Treasury to the credit of the appropriations.

MONTHLY CHECK STATEMENTS.

The check statements submitted by the Treasury and subtreasuries were compared with the checks issued by this division and the amounts verified.

PUBLIC MONEYS RECEIVED FROM VARIOUS SOURCES.

There were received from various sources and deposited in the Treasury to the credit of the proper funds the following sums:

Miscellaneous receipts, sales of condemned property, etc.....	\$23, 861. 45
Sales of products, agricultural station, Hawaii.....	570. 90
Sales of products, agricultural station, Porto Rico.....	1, 951. 62
Sales of products, agricultural station, Alaska.....	6, 283. 83
Sales of products, agricultural station, Guam.....	43. 64
Total.....	32, 711. 44

BUILDINGS RENTED IN THE DISTRICT OF COLUMBIA.

The following statement shows the buildings under rent in the District of Columbia on June 30, 1913.

Buildings rented in the District of Columbia.

Location of buildings.	For what purpose used.	Annual rental.
No. 1362 B Street SW ¹	Bureau of Animal Industry, offices.....	\$1,800.00
Nos. 1224-1226 B Street SW.....	Bureau of Animal Industry, offices and storage purposes.	420.00
Rooms 914 and 915, Munsey Building...	Bureau of Animal Industry, offices.....	420.00
Rear of 1223 C Street SW ²	Bureau of Animal Industry, stable.....	96.00
Atlantic Building.....	Forest Service, offices.....	24,805.00
No. 913 E Street NW.....	Forest Service, carpenter shop.....	270.00
No. 215 Thirteenth Street SW.....	Division of Publications, document rooms.....	5,000.00
No. 201 Thirteenth Street SW ³	Bureau of Plant Industry, offices and laboratories.....	120.00
No. 203 Thirteenth Street SW ⁴	do.....	140.00
No. 205 Thirteenth Street SW ⁴	do.....	140.00
No. 207 Thirteenth Street SW ⁴	do.....	140.00
No. 207½ Thirteenth Street SW ⁴	do.....	140.00
No. 209 Thirteenth Street SW ⁴	do.....	140.00
No. 224 Twelfth Street SW.....	do.....	2,500.00
Nos. 1304-1306 B Street SW.....	Bureau of Plant Industry, offices, laboratories, and storage rooms.	2,500.00
Nos. 1308-1310 B Street SW ⁵	do.....	120.00
Nos. 221-223 Linworth Place SW ⁶	Bureau of Plant Industry, seed building.....	800.00
No. 1353 B Street SW.....	Bureau of Plant Industry, offices.....	750.00
No. 1360 B Street SW.....	do.....	420.00
No. 1354 B Street SW ⁷	Bureau of Plant Industry and Insecticide Board.....	375.00
No. 219 Thirteenth Street SW.....	Bureau of Soils, storage.....	306.00
No. 212 Thirteenth Street SW.....	Bureau of Chemistry, offices and laboratories.....	660.00
No. 214 Thirteenth Street SW.....	do.....	660.00
No. 216 Thirteenth Street SW.....	do.....	16,000.00
Nos. 200-202 Fourteenth Street SW.....	Office of Public Roads, offices and laboratories.....	3,500.00
No. 1316 B Street SW.....	Office of the Solicitor, offices.....	2,160.00
No. 215 Twelfth Street SW ⁸	Office of Experiment Stations, offices.....	180.00
No. 221 Linworth Place SW.....	Bureau of Animal Industry and Bureau of Plant Industry, offices and warehouse, Mar. 1 to June 30, 1913, at \$5,400 per annum.	1,800.00
Third floor of Evening Star Building....	Bureau of Animal Industry, offices, 8 months, at \$200 per month.	1,600.00
Six-story and basement building, situated on lots 10 and 11, square 263.	Bureau of Plant Industry and Office of Experiment Stations, offices and laboratories, Sept. 1 to June 30, 1913, at \$20,000 per annum.	16,666.60
No. 220 Thirteenth Street SW.....	Insecticide and Fungicide Board, offices and laboratory May 16 to June 30, 1913, at \$3,000 per annum.	379.03
Room 409 Evening Star Building.....	Bureau of Entomology, offices, 3 months, at \$25 per month.	75.00
Rooms 410 and 411 Evening Star Building.	Bureau of Entomology, offices, 7½ months at \$60 per month.	450.00
Total.....		\$5,532.63

¹ For a period of 7 months, at \$60 per month, \$420.² For a period of 8 months, at \$12 per month, \$96.³ For a period of 4 months, at \$30 per month, \$120.⁴ For a period of 4 months, at \$35 per month, \$140.⁵ For a period of 4 months, at \$30 per month, \$120.⁶ For a period of 2 months, at \$400 per month, \$800.⁷ For a period of 10 months, at \$37.50 per month, \$375.⁸ For a period of 3 months, at \$60 per month, \$180.

FISCAL AFFAIRS OF THE FOREST SERVICE.

The following statistics are furnished by the fiscal agents of the Forest Service:

Statement of the fiscal transactions of the Forest Service.

	District 1, Missoula.	District 2, Denver.	District 3, Albuquerque.	District 4, Ogden.	District 5, San Francisco.	District 6, Portland.	Washington and Madison.	Total.
Number of requisitions for purchase of supplies.....	208	250	.....	1,717	78	128	2,652	5,033
Number of letters of authorization for travel.....	570	975	272	261	318	90	289	2,775
Number of accounts paid during the fiscal year 1913, including those paid from cooperative and cooperative fire protection.....	8,965	9,237	6,976	9,518	10,133	8,656	3,761	57,246
Number of Alutachian accounts audited.....							2,440	2,440
Total amount paid from 1913 appropriations, including cooperative. Total amount paid from 1912 appropriations under waiver from the Treasury Department.....	\$800,567.78	\$690,127.10	\$565,087.64	\$762,968.83	\$754,653.89	\$752,507.78	\$598,600.00	\$4,924,523.02
Number of checks drawn.....	\$95,129.75	\$86,886.74	\$72,744.61	\$143,842.88	\$71,659.23	\$77,661.75	\$78,453.55	\$626,378.51
Number of passenger transportation requisitions issued.....	17,188	18,266	14,690	15,984	19,652	16,972	6,288	108,990
Number of bills of lading issued for freight and express.....	1,000	1,433	1,284	1,040	1,020	1,256	2,400	9,502
Amount received from sale of property and condemned Government prop- erty, lost property, etc.....	1,320	1,344	.....	1,727	1,355	911	1,286	7,943
Number of accounts forwarded to Treasury for settlement: 1911.....	\$194.50	\$631.60	\$342.82	\$1,428.89	\$8.50	\$943.49	\$703.22	\$4,254.02
1912.....	.....	.....	.....	.....	.....	.....	89	89
1913.....	.....	.....	.....	.....	.....	.....	657	657
Number of checks lost.....	26	15	23	18	47	18	1,122	1,148
Number of letters written and received in the ordinary transaction of business.....	9,223	9,500	15,168	7,000	12,117	9,000	25,172	87,180
Amount received from timber sales, etc.....	\$468,959.21	\$339,085.02	\$542,985.35	\$413,883.72	\$318,071.89	\$387,609.32	\$130.10	\$2,471,624.61
Amount received for cooperative work.....	\$5,000.00	.....	.....	.....	\$744.78	.....	\$1,046.52	\$6,791.30
Number of requisitions drawn on the Treasury for advances.....	14	11	14	10	18	19	12	98
Number of temporary special disbursing agents and district fiscal agents active.....	1	1	1	1	3	2	2	11
Number of requisitions issued.....	14	11	14	10	18	19	12	98
Amount of requisitions issued.....	\$933,545.63	\$728,402.00	\$650,500.00	\$857,000.00	\$926,006.75	\$559,078.83	\$292,000.00	\$5,246,623.21

¹ Includes \$2,914.71 collected for Uinta Indians.

² Includes \$989.73 collected in Timber Trespass case as "fees and costs."

*Statement of appropriations, disbursements, and unexpended balances for the United States
Department of Agriculture, etc.*

Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
1839..	\$1,000.00	\$1,000.00		1878..	\$198,640.00	\$197,634.94	\$1,005.06
1840..				1879..	206,400.00	206,360.00	40.00
1841..				1880..	199,500.00	198,361.72	1,138.28
1842..	1,000.00	1,000.00		1881..	275,460.31	267,608.84	¹ 7,851.47
1843..				1882..	363,011.05	354,482.39	² 8,528.66
1844..	2,000.00	2,000.00		1883..	456,396.11	438,941.72	³ 17,454.39
1845..	2,000.00	2,000.00		1884..	⁴ 416,641.10	413,618.09	3,023.04
1846..	3,000.00	3,000.00		1885..	⁵ 655,930.25	558,934.89	⁶ 96,995.36
1847..	3,000.00	3,000.00		1886..	⁷ 677,973.22	519,196.11	158,777.11
1848..	4,500.00	4,500.00		1887..	⁸ 657,641.81	628,287.14	29,354.67
1849..	3,500.00	3,500.00		1888 ⁶ ..	1,027,219.06	1,011,282.62	15,936.44
1850..	5,500.00	5,500.00		1889..	⁹ 1,134,480.60	1,033,590.22	⁷ 100,890.38
1851..	5,500.00	5,500.00		1890..	¹⁰ 1,170,139.11	971,823.62	⁸ 198,315.49
1852..	5,000.00	5,000.00		1891..	¹¹ 1,372,049.21	1,266,277.36	105,771.85
1853..	5,000.00	5,000.00		1892..	¹² 303,655.75	2,253,262.29	50,393.46
1854..	10,000.00	10,000.00		1893..	2,540,060.72	2,355,430.25	184,630.47
1855..	⁴ 50,000.00	50,000.00		1894..	2,603,855.58	1,977,469.28	⁹ 626,386.30
1856..	30,000.00	30,000.00		1895..	¹³ 2,506,915.00	2,021,030.38	485,884.62
1857..	75,000.00	75,000.00		1896..	2,584,013.22	2,094,916.42	489,096.80
1858..	63,500.00	63,157.25	\$342.75	1897..	2,448,763.53	2,348,512.98	100,250.55
1859..	60,000.00	60,000.00		1898..	2,467,902.00	2,425,510.44	42,391.56
1860..	40,000.00	40,000.00		1899..	2,829,702.00	2,827,795.65	28,899.27
1861..	60,000.00	60,000.00		1900..	3,006,022.00	2,947,603.42	58,418.58
1862..	64,000.00	63,704.21	295.79	1901..	3,304,265.97	3,239,137.39	65,128.58
1863..	80,000.00	80,000.00		1902..	3,922,780.61	3,902,675.79	20,104.72
1864..	199,770.00	189,270.00	10,500.00	1903..	5,015,846.00	4,734,230.84	281,615.16
1865..	112,304.05	112,196.55	107.50	1904..	5,025,024.01	4,969,311.64	55,712.37
1866..	167,787.82	167,787.82		1905..	5,894,540.00	5,820,204.00	74,336.00
1867..	199,100.00	199,100.00		1906..	6,225,690.00	6,029,510.02	196,179.98
1868..	279,020.00	277,094.34	1,925.66	1907..	9,505,484.74	9,025,318.93	1,200,165.81
1869..	172,593.00	172,593.00		1908..	11,487,950.82	11,045,412.19	442,538.63
1870..	156,440.00	151,596.93	4,843.07	1909..	15,385,806.00	15,079,472.29	306,333.71
1871..	¹⁴ 188,180.00	186,876.81	1,303.19	1910..	15,958,811.27	15,547,983.00	410,828.27
1872..	197,070.00	195,977.25	1,092.75	1911..	17,278,976.10	16,814,726.93	464,249.17
1873..	202,440.00	201,321.22	1,118.78	1912 ¹⁰ ..	23,090,842.15	17,772,993.80	5,317,848.35
1874..	257,690.00	233,765.78	23,924.22	1913..	24,735,135.80	18,301,453.09	6,433,682.71
1875..	337,380.00	321,079.83	16,300.17				
1876..	249,120.00	198,843.64	50,276.36	Total	¹¹ 181,731,407.46	¹² 163,665,743.96	¹³ 17,871,425.86
1877..	194,686.96	188,206.19	6,480.77				

¹ Includes \$1,646.45 of the appropriation for reclamation of arid lands, carried to the fiscal year 1882.

² Includes \$85.26 of the appropriation for reclamation of arid lands and \$3,530.85 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1883.

³ Includes \$7,656.13 of the appropriation for reclamation of arid lands, carried to the fiscal year 1884.

⁴ Including deficiency appropriation.

⁵ Includes \$93,192.27 of the appropriation for Bureau of Animal Industry and \$2,970.82 of the appropriation for quarantine stations, carried to the fiscal year 1886.

⁶ For the fiscal year 1888, including the sum of \$8,000 appropriated for deficiencies in the appropriation or experiments in the manufacture of sugar for the fiscal years 1887 and 1888, of which \$7,927.50 was disbursed and \$72.50 remained unexpended.

⁷ Includes \$12,923.25 of the appropriation for botanical investigations and \$58,364.76 of the appropriation or experiments in the manufacture of sugar, carried to the fiscal year 1890.

⁸ Includes \$188,974.69 of the appropriation for Bureau of Animal Industry, carried to the fiscal year 1891.

⁹ Includes \$7,891.94 for statutory salaries of the year 1894.

¹⁰ For the years 1912 and 1913 the figures given represent payments made to close of June 30, 1912, the accounts for those years being still open at the date of this revision.

¹¹ This total is the amount actually appropriated for the various fiscal years, with the exception of \$37,604.70 appropriated July 13, 1868, to cover a number of expenditures made in previous years. It does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

¹² Does not include \$37,604.70 which was disbursed during several years and covered by an appropriation of like amount made July 13, 1868. (See note ¹¹.)

¹³ Does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

REPORT OF THE EDITOR.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., September 1, 1913.

SIR: I have the honor to submit herewith the report of the operations of the Division of Publications for the fiscal year ended June 30, 1913.

Very respectfully,

JOS. A. ARNOLD,
Editor and Chief.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

SUMMARY.

During the year, 1,771 new bulletins, circulars, reports, and publications of all kinds were issued by the department, the total number of copies of new pamphlets aggregating 23,980,416. There were issued through the Division of Publications 1,676 documents and 95 through the Weather Bureau.

The total output of publications was 33,356,366 copies, of which 9,375,950 were reprints. The miscellaneous publications of the various bureaus, divisions, and offices numbered 23,675,516 copies, while there were 9,680,850 Farmers' Bulletins printed. Of the miscellaneous publications, 21,591,616 were new and 2,083,900 were reprints. The amount expended for periodical publications was \$38,310.23. The amount expended for administrative blanks, blank books, etc., was \$88,192.89. The amount expended for publications the printing of which is authorized by Congress was \$55,747.49.

The number of employees in the division was 207 for three months, and 161 for nine months. The department's allotment of the appropriation for printing and binding was \$475,000; the appropriation for salaries in the division was \$194,700; the appropriation for miscellaneous expenses of the division was \$25,000.

The actual expenditures under the supervision of this division were as follows:

Printing and binding.....	\$427, 999. 44
Salaries of employees (all on statutory roll).....	161, 574. 60
Miscellaneous expenses, including rent, materials, supplies, etc.....	14, 923. 76
Total.....	604, 497. 80

For the purpose of comparison the following statement of appropriations under the supervision of this division for the fiscal years ending June 30, 1910, 1911, 1912, and 1913, is given:

Appropriations.	1910	1911	1912	1913
Statutory roll of the division.....	\$173, 450	\$172, 730	\$179, 960	\$194, 700
General printing fund.....	435, 000	435, 000	423, 000	423, 000
General expenses of the division.....	33, 000	30, 000	30, 000	25, 000
Total.....	641, 450	637, 730	632, 960	647, 700

Even with the most economical administration, the printing fund was found insufficient to meet the requirements of the department during the year, with the result that a considerable amount of work could not be completed, and more than 60 publications containing the results of important investigations were not printed.

CHANGE IN THE METHOD OF DISTRIBUTION OF PUBLICATIONS.

The new feature of the work of the year was the transfer, on October 1, 1912, in accordance with the provisions of section 8 of the act of August 23, 1912, of the actual mailing of the publications intended for public distribution to the Government Printing Office.

The actual transfer of the documents began early in September, and by October 1, 1912, 5,519,929 copies were turned over to the Public Printer, of which 2,168,029 were publications of the various bureaus, offices, and divisions of the department, and 3,351,900 were Farmers' Bulletins.

Since October 1, 1912, the distribution of all bulletins, circulars, reports, etc., has been made by the Superintendent of Documents, office of the Public Printer, upon order from the chief of this division, who is designated by the Secretary to make such orders and generally to supervise the distribution. There was necessarily confusion and delay in the actual mailing of publications at first, but the advantage of the distribution to regular mailing lists through the Public Printer is admitted, although the distribution to miscellaneous applicants could probably always be done more satisfactorily by the department.

Under the law, circulars of information, letters of inquiry, administrative blanks, orders, notices, etc., may be mailed by the department, and as there are millions of these the distribution occupies continuously a considerable force. Thirty-eight employees who were engaged solely in connection with the work of mailing publications were dropped from the rolls on the expiration of September 30, 1912. The aggregate of their salaries was \$33,160. A few of the employees were taken on at the Government Printing Office, some of them secured positions in other bureaus, while others have not yet been able to secure employment.

EXPENDITURES FOR PRINTING AND BINDING.

The number of requisitions for printing and binding made upon the Government Printing Office was 4,505. The appropriation for printing and binding was \$5,000 more than that for the preceding fiscal year, or \$475,000. Of this amount, \$47,000 was expended

by the Weather Bureau. Of the remaining \$428,000, \$318,527.33 was expended for miscellaneous bulletins, job printing, etc., and \$109,472.11 for Farmers' Bulletins.

The amounts expended for miscellaneous publications and for job printing and binding for the various bureaus, divisions, and offices are given in detail in the following table:

Expenditures for printing and binding for the various bureaus, divisions, and offices, not including the Weather Bureau, during the fiscal year ended June 30, 1913.

Bureau, division, or office.	Regular bulletins, circulars, and reports.	Serial publications.	Reports authorized by Congress.	Job printing.	Binding.	Total expenditures.	Increase (+) or decrease (−) over 1912.
Division of Accounts...	\$522.77	.....	\$8,045.15	\$6,624.89	\$24.20	\$15,217.01	+\$10,042.43
Bureau of Animal Industry.....	8,958.45	\$689.46	3,577.30	10,976.38	125.65	24,327.24	+ 2,361.15
Bureau of Biological Survey.....	2,165.76	.....	.....	535.43	73.50	2,774.69	− 4,788.06
Bureau of Chemistry.....	18,557.64	.....	322.06	3,153.89	1,170.75	23,204.34	+ 10,470.22
Bureau of Entomology.....	14,825.54	.....	.....	1,542.96	95.30	16,463.80	+ 1,419.52
Office of Experiment Stations.....	11,736.88	15,831.01	989.29	2,930.79	795.63	32,283.60	+ 1,363.13
Forest Service.....	12,221.86	480.45	.....	18,405.16	264.60	31,372.07	+ 17,180.54
Library.....	1,081.14	2,823.91	.....	2,258.61	7,679.65	13,843.31	+ 1,029.36
Bureau of Plant Industry.....	22,236.78	.....	.....	22,926.48	153.04	45,316.30	+ 9,325.44
Division of Publications.....	1,588.08	7,189.70	.....	1,710.65	10,562.43	.....	− 864.06
Office of Public Roads.....	3,952.02	.....	27,586.03	460.41	74.00	4,419.23	− 780.13
Bureau of Soils.....	5,791.76	.....	.....	448.99	11.60	33,838.38	+ 28,098.26
Bureau of Statistics.....	11,157.73	11,295.70	.....	6,217.32	184.35	28,855.10	+ 1,102.95
Miscellaneous.....	9,775.44	.....	15,227.66	9,707.75	785.50	35,496.35	+ 9,319.65
Insecticide and Fungicide Board.....	260.25	.....	.....	293.18	.....	553.43	+ 553.43
Total.....	124,832.10	38,310.23	55,747.49	88,192.89	11,444.62	318,527.33	.....

Not all of the work that was forwarded to the Printing Office was completed and delivered, therefore in numerous instances only first charges are shown in the above table, the second charges, aggregating a considerable sum, being carried over and charged against the fund for printing for the fiscal year ending June 30, 1914.

There has been an increase in the expenditure for printing publications authorized by Congress, due to the increase in the size of such publications, the amount for the year aggregating \$55,747.49.

The amount expended for administrative blanks of all kinds, and for job printing generally, aggregated \$88,192.89. The expenditures for the regular bulletins and circulars of the various bureaus, divisions, and offices was only \$89,119.91. The aggregate expenditure for publication work proper, including reprints and separates, exclusive of Farmers' Bulletins, was \$124,832.10. At least \$50,000 more could and should have been spent, if funds had been available, for bulletins prepared and submitted containing the results of investigations authorized by law. The amount spent for printing and binding, exclusive of Farmers' Bulletins and for the Weather Bureau, was \$318,527.33.

For the purpose of comparison, the following statement showing the output of publications of the department for the years 1910, 1911, 1912, and 1913 is given.

Output of publications from the department for the fiscal years 1910, 1911, 1912, and 1913 compared.

	1910	1911	1912	1913
Number of editions issued.....	1,983	1,953	2,110	2,200
Number of copies printed.....	25,190,465	27,594,877	34,678,557	33,356,366

The following statement shows the total number of copies of all publications of the department issued during the last 24 years:

Publications of all kinds issued by the department, 1890-1913.

Years.	Number issued.	Years.	Number issued.	Years.	Number issued.	Years.	Number issued.
1890.....	1,904,300	1897.....	6,541,210	1904.....	12,421,386	1911.....	27,594,877
1891.....	2,833,933	1898.....	6,280,365	1905.....	12,475,157	1912.....	34,678,557
1892.....	2,348,797	1899.....	7,075,975	1906.....	13,488,527	1913.....	33,356,366
1893.....	3,446,181	1900.....	7,152,428	1907.....	16,746,910	Total.....	291,607,390
1894.....	3,169,310	1901.....	7,889,281	1908.....	16,875,516		
1895.....	4,100,660	1902.....	10,586,580	1909.....	17,190,345		
1896.....	6,561,700	1903.....	11,698,564	1910.....	25,190,465		

SALES OF DEPARTMENT PUBLICATIONS.

Notwithstanding the free distribution of publications by the department, the sales by the Superintendent of Documents aggregated during the year 183,139 copies, for which \$17,885.40 was received. The sales of the department's publications within the last four years are shown in the accompanying table:

Sales of agricultural publications by the Superintendent of Documents during the fiscal years 1910-13.

Years.	Number of copies.	Amount received.	Years.	Number of copies.	Amount received.
1910.....	147,327	\$18,398.18	1912.....	171,866	\$16,428.07
1911.....	183,577	18,657.17	1913.....	183,139	17,885.40

It will be observed that the number of copies sold during this fiscal year was about the number sold in 1911, although the amount received was \$771.77 less, while each of those years exceeded both in output and amount received the year 1912.

AUTHORITY TO REPRINT.

Under a wise provision of the law of January 12, 1895, the Superintendent of Documents is authorized to reprint and sell any publication, the proceeds to cover the cost and handling thereof. It is possible, therefore, to secure Government publications from that official when they can no longer be obtained from the department issuing them. The following statement shows the classes of publications of this department reprinted by the Superintendent of Documents during the fiscal year ending June 30, 1913.

Classes of agricultural publications reissued by the Superintendent of Documents during the fiscal year 1912-13.

Class of publication.	Number.	Copies.
Reports.....	2	1,150
Bulletins.....	214	57,675
Circulars.....	193	24,400
Experiment Station Record.....	7	2,800
Farmers' Bulletins.....	196	38,750
Total.....	612	124,775

The following table shows the publications of the department reprinted by the Superintendent of Documents, classified according to bureaus, divisions, and offices:

Agricultural publications reissued by the Superintendent of Documents during the fiscal year 1913, classified according to bureaus or offices.

Bureau or office.	Number.	Copies.	Bureau or office.	Number.	Copies.
Office of the Secretary.....	234	41,850	Bureau of Plant Industry..	82	17,700
Bureau of Animal Industry..	43	8,450	Office of Public Roads.....	6	2,500
Biological Survey.....	9	1,100	Bureau of Soils.....	25	4,325
Bureau of Chemistry.....	49	14,650	Bureau of Statistics.....	14	2,250
Bureau of Entomology.....	65	12,600	Weather Bureau.....	6	500
Office of Experiment Sta- tions.....	32	10,100	Total.....	608	124,775
Forest Service.....	43	8,750			

Of the scientific and technical publications sold by the Superintendent of Documents, Office of Experiment Stations Bulletin No. 28, Chemical Composition of American Foods, Chemistry Bulletin No. 107, Methods of Analysis, and the Food Charts are distinctly in the lead. There are five others of which the Superintendent of Documents sold between 500 and 1,600 copies. The Farmers' Bulletin No. 513, Fifty Common Birds of Farm and Orchard, was in greater demand than any other publication of the department, and in addition to the 200,000 distributed free by the department and Senators, Representatives, and Delegates in Congress, the Superintendent of Documents sold over 3,900. The highest-priced bulletin of the department was Bulletin Q of the Weather Bureau, of which the Superintendent of Documents sold five copies at \$10 each.

Under the law of January 12, 1895, all remittances for publications should be forwarded to the Superintendent of Documents, Government Printing Office. Although instructions are printed at the head of the Monthly List of Publications advising applicants to apply to that official when they desire to obtain publications after the department's supply is exhausted, remittances continue to be sent to this office, the amount received during the year being \$2,488.66. A careful record of all moneys so received and forwarded to the Superintendent of Documents is maintained in this division.

PUBLICATIONS OF THE WEATHER BUREAU.

Of the appropriation for the department for printing and binding, a specific sum, namely, \$47,000, is allotted to the Weather Bureau, the expenditure of which is under the supervision of that bureau.

OCEAN AND GREAT LAKES CHARTS.—The bureau has continued the issue of meteorological charts of the oceans and Great Lakes. The charts are 21 by 28 inches in size, are printed in colors, and are published monthly and quarterly.

CLIMATOLOGICAL REPORTS.—From the 12 drainage districts of the United States, climatological data are received and distributed monthly, in quarto form, and in number averaging about 1,100 from a district.

WEATHER MAPS AND BULLETINS.—Weather Bureau stations in all the States issue a large number of maps, bulletins, and forecast cards. Daily weather maps and bulletins were issued at 111 stations, the total annual circulation amounting to about 9,900,000, a considerable increase over the total yearly circulation for the fiscal year ended June 30, 1912. At 40 of the stations named above the publications were printed, and at the remaining 71 stations they were prepared by duplicating processes.

The station map is a sheet 11 by 16 inches, and the subscription price is 20 cents a month or \$2 a year.

In addition to the maps and bulletins mentioned above, regular Weather Bureau stations and substations distributed free of charge 27,450,000 forecast cards during the fiscal year ended June 30, 1913.

Commercial maps were published in 135 newspapers throughout the country, representing a total annual circulation of about 774,700,000 copies.

EXPENDITURES FOR PRINTING AND BINDING, BY BUREAUS.

A résumé of the printing and binding expenditures of the department during the year is given below, by bureaus, divisions, and offices:

Statement showing aggregate expenditures for printing and binding for the various bureaus, divisions, and offices, not including Farmers' Bulletins, during the fiscal year ended June 30, 1913.

Division of Accounts and Disbursements.....	\$15,217.01
Bureau of Animal Industry.....	24,327.24
Bureau of Biological Survey.....	2,774.69
Bureau of Chemistry.....	23,204.34
Bureau of Entomology.....	16,463.80
Office of Experiment Stations.....	32,283.60
Forest Service.....	31,372.07
Library.....	13,843.31
Bureau of Plant Industry.....	45,316.30
Division of Publications.....	10,562.43
Office of Public Roads.....	4,419.28
Bureau of Soils.....	33,838.38
Bureau of Statistics.....	28,855.10
Miscellaneous (Secretary).....	35,496.35
Insecticide Board.....	553.43
Weather Bureau.....	47,000.00
Total.....	365,527.33

FARMERS' BULLETINS.

Farmers' Bulletins continue to be popular. Since the series was established in 1890, 542 bulletins have been issued. During the year 42 new Farmers' Bulletins were prepared and printed, the total number of copies being 2,388,800. Of earlier numbers still in demand, 285 were reprinted, and the aggregate number of copies of all Farmers' Bulletins printed during the year was 9,680,850.

It is planned to improve this series by brevity, clearness of statement, and by adapting them to restricted localities. The demand for these bulletins from schools of all grades and institutions of higher education continues to increase and ought to be encouraged even at the expense of additional appropriation for printing them.

The following table shows the output of Farmers' Bulletins during the last seven years and the expenditure therefor:

Output of Farmers' Bulletins and the cost for the fiscal years 1907, 1908, 1909, 1910, 1911, 1912, and 1913.

Fiscal year.	Fund drawn upon.	Number issued.	Number of copies.	Cost.
1907.....	Farmers' Bulletin fund.....	235	6,469,000	\$98,601.17
1908.....	do.....	252	6,574,500	98,601.49
1909.....	do.....	271	7,755,000	122,475.48
1910.....	do.....	299	9,337,500	126,579.37
1911.....	do.....	295	9,219,000	118,012.06
1912.....	do.....	344	10,409,000	122,753.33
1913.....	do.....	327	9,680,850	109,472.11

CONGRESSIONAL DISTRIBUTION OF FARMERS' BULLETINS.

The appropriation for Farmers' Bulletins was \$125,000, the same as last year, and the quota to each Senator, Representative, and Delegate was the same, namely, 12,500 copies. With the amount appropriated 9,680,850 copies were printed, of which 5,803,088 were distributed upon the orders of Senators, Representatives, and Delegates. Numerous other publications when available were furnished to them.

In this connection the following table is interesting as showing the growth of the Farmers' Bulletin series during the 24 years, with the congressional distribution:

Growth of the Farmers' Bulletin series during 24 years, with congressional distribution.

Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.	Year.	New bulletins issued.	Total number of copies printed.	Copies distributed by Congressmen.
1890-1893.....	14	540,000	-----	1905.....	24	5,925,500	4,782,643
1894.....	5	278,500	-----	1906.....	33	6,568,000	5,279,476
1895.....	11	1,567,000	885,770	1907.....	42	6,469,000	3,484,713
1896.....	13	1,891,000	1,316,695	1908.....	26	6,574,500	3,928,437
1897.....	16	2,387,000	1,967,237	1909.....	34	7,755,000	3,960,642
1898.....	21	2,170,000	1,580,065	1910.....	45	9,337,500	6,449,589
1899.....	22	2,437,000	1,101,985	1911.....	48	9,219,000	5,474,079
1900.....	18	2,360,000	1,666,909	1912.....	44	10,409,000	7,351,262
1901.....	14	3,345,000	2,195,010	1913.....	42	9,680,850	5,803,088
1902.....	23	6,150,000	4,289,126	Total.....	542	108,100,850	70,367,258
1903.....	22	6,602,000	3,954,976				
1904.....	25	6,435,000	4,895,556				

On account of the increase in the membership of the Sixty-third Congress, an increase of \$12,500 was made in the appropriation for the fiscal year 1914 in order to supply each additional Member with an allotment of 12,500 copies of the Farmers' Bulletins.

EDITING.

The increase of more than 40 per cent of new work over last year, as shown in the statement below, and an increase of 400 per cent in 10 years has been accompanied by a decrease of 33 per cent in the number of reprints below last year and 16 per cent from 10 years ago. This augments the work of the editors even more than comparison of the total output would indicate.

The following table gives the figures for the years 1904-1913, both inclusive:

Year.	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
New publications...	379	391	414	521	447	650	1,085	¹ 1,170	¹ 1,250	¹ 1,771
Reprints.....	514	596	654	819	998	485	462	696	648	429
Total.....	893	987	1,068	1,340	1,445	1,135	1,547	1,866	1,898	2,200

¹ Not including press notices which were mimeographed.

The tables following, presenting a detailed statement with regard to the publications issued by the department, will, by the great bulk of printed matter shown, give a good idea of the large amount of work demanded of the editorial force.

Publications issued by the department during the fiscal year 1913, classified according to the bureau, division, or office contributing them.

ALL PUBLICATIONS, INCLUDING FARMERS' BULLETINS.

ALL PUBLICATIONS EXCEPT FARMERS' BULLETINS.

[illegible]

SUMMARY OF PUBLICATIONS WORK—Continued.

Publications issued by the department during the fiscal year 1913, classified according to the bureau, division, or office contributing them—Continued.

ALL PUBLICATIONS EXCEPT FARMERS' BULLETINS—Continued.

Bureau, division, or office contributing publications.	New.				Earlier issues reprinted.				Total.		
	Number.	Pages.	Illustrations.	Copies.	Number.	Pages.	Illustrations.	Copies.	Number.	Pages.	Illustrations.
Division of Publications.....	30	148	.....	5,536,500	12	143	.....	120,000	42	291	.....
Office of Public Roads.....	8	367	61	64,500	4	195	43	15,000	12	562	104
Bureau of Soils.....	25	848	43	57,200	2	54	30	3,000	27	902	73
Bureau of Statistics.....	43	1,414	48	2,519,800	.....	.....	.....	.....	43	1,414	48
Weather Bureau.....	95	2,931	693	319,293	1	37	10	1,000	95	2,938	703
Total.....	1,729	34,638	3,649	21,591,616	144	4,292	938	2,083,900	1,873	38,900	4,587
											23,675,516

FARMERS' BULLETINS.

Bureau of Animal Industry.....	4	118	36	230,300	29	840	325	1,021,500	33	958	361	1,251,800
Biological Survey.....	4	126	73	360,000	8	230	76	106,500	12	356	149	466,500
Bureau of Chemistry.....	2	82	24	195,000	8	192	46	225,500	10	274	70	420,500
Bureau of Entomology.....	2	93	29	145,000	13	357	151	265,000	15	450	180	410,000
Office of Experiment Stations.....	8	208	32	336,200	95	3,076	592	2,378,200	103	3,284	624	2,714,400
Forest Service.....	.....	.....	.....	.....	4	146	80	69,800	4	146	80	69,800
Bureau of Plant Industry.....	21	442	127	1,027,300	110	2,776	1,034	2,588,450	131	3,218	1,161	3,615,750
Division of Publications.....	.....	.....	.....	.....	6	182	88	255,000	6	182	68	255,000
Office of Public Roads.....	1	20	8	95,000	6	165	39	177,100	7	185	47	272,100
Bureau of Soils.....	.....	.....	.....	.....	4	150	27	185,000	4	150	27	185,000
Weather Bureau.....	.....	.....	.....	.....	2	55	7	20,000	2	55	7	20,000
Total.....	42	1,089	329	2,388,800	285	8,169	2,445	7,292,050	327	9,258	2,774	9,680,850

The work above enumerated involved the reading and editing of the manuscripts, the preparation of the same and of the illustrations for the printer, the reading and revising of galley and page proofs, besides advising and making plans for 3,044 blanks and other job work.

Other work done but not susceptible of tabulation included: Compiling occasional manuscripts; writing press notices; drafting letters; preparing reports; selecting matter for use of newspaper and magazine writers; listing and cataloguing all completed publications as received from the printer; preparing memoranda upon special topics arising in connection with publication work; collating information in response to requests (e. g., matter for Congressional Directory); making recommendations for awards of contracts for illustrations for department publications; inspecting illustrations upon delivery, especially maps and colored work.

INDEXING.

Two card indexes maintained, namely, one showing publications available for distribution and another showing references to most of the subjects treated in nearly all of the publications of the department since 1905, together with the names of authors of articles and publications issued by this department, were reasonably well up to date and a little more complete than on the same day at the close of the fiscal year 1912. This involved the writing and handling of many thousand index cards, and it will be remembered that one of these indexes, that of available publications, is changing daily so as to show what publications can be secured from the department supply in the Government Printing Office as well as what publications are for sale by the Superintendent of Documents. Both indexes are coming to be better known, and the calls for information by the several branches of the department have increased notably during the present year.

Indexes have been made for the books published by the department and by other departments of a total numbering nearly 5,700 pages. Of these, about 1,300 pages were upon special requests for the General Supplies Committee in the Treasury Department. The total number of pages indexed, including those for the card indexes, was over 33,000.

About 6,000 requests for special references and publications have been received and answered involving the writing of some 5,000 letters.

ILLUSTRATING.

The number of drawings prepared by the three draftsmen during the year total 1,512.

This showing is especially commendable when it is taken in consideration that the year's work was noteworthy for the number of drawings of intricate design and large dimensions, requiring an unusual length of time to complete.

In the photographic laboratory a total of 83,605 pieces were prepared.

A gratifying feature of the work is the growing tendency of the scientists of the various bureaus and offices to avail themselves of the facilities of this laboratory for producing the original negatives

needed in their researches. This item shows a large increase over previous years.

The following is a summary of the work of the photographic laboratory during the past fiscal year:

Summary of photographic work done during the fiscal year ended June 30, 1913.

Contact prints, developing paper.....	46, 520
Negatives made (dry plates).....	4, 366
Negatives made (wet plates).....	130
Lantern slides.....	3, 792
Lantern slides, colored.....	322
Plates and films developed.....	4, 604
Bromide enlargements.....	1, 436
Bromide enlargements, colored.....	5
Solar bromide prints.....	2, 622
Blue prints.....	10, 185
Prints mounted.....	9, 623
Total.....	83, 605

Two hundred and thirty requests were received from persons outside of the department for photographs or lantern slides. The cost of this work amounted to \$326.33, of which \$305.76 was collected and turned over to the disbursing office and \$20.57 remains unpaid.

Besides these paid orders, a number of requests were received for duplicates of originals of illustrations appearing in department publications. These duplicates were furnished by electrotypes at the applicant's expense.

DISTRIBUTION OF DOCUMENTS.

On July 1, 1912, there were 5,266,699 publications on hand in this office, of which 2,080,786 were miscellaneous publications and 3,185,913 were Farmers' Bulletins. During the period July 1 to September 30, 1912, 5,982,080 publications were received, together with the number on hand July 1, 1912, making a total of 11,248,779 documents available for distribution during this period, 6,003,192 of which were distributed, to wit, miscellaneous, 4,314,936; Farmers' Bulletins, 1,688,256. On October 1, 1912, in accordance with law, the 5,519,929 publications remaining on hand were transferred to the Government Printing Office. Between October 1, 1912, and June 30, 1913, the Superintendent of Documents received from the Public Printer all of the publications of this department, and there were distributed through that office 23,519,625 publications upon orders issued by this division. Of this number, 16,332,939 copies were miscellaneous and 7,186,686 were Farmers' Bulletins. The entire number distributed from this division and through the Government Printing Office was 33,322,817 publications, of which 20,647,875 were miscellaneous publications, 8,874,942 Farmers' Bulletins, and 3,800,000 were lists of available Farmers' Bulletins.

On July 1, 1913, there remained on hand at the Government Printing Office 5,345,881 publications, of which 1,365,410 were miscellaneous publications and 3,980,471 were Farmers' Bulletins.

During the fiscal year 587,360 communications were received from miscellaneous applicants requesting publications. To attend to these necessitated the selection in most cases of the publications to be sent

and the issuing of 526,452 orders for the mailing of the same on the folding rooms or (subsequent to October 1, 1912) on the Public Printer, and the addressing and mailing of 512,220 "Quote cards," supplying applicants with the price of the publications the department's supply of which was exhausted. In addition to this great number of circulars and post cards, 65,027 typewritten letters were prepared, the greater number of which were in reply to communications received from Members of Congress in regard to the distribution of the Farmers' Bulletins allotted to them by law.

An important feature of the work is the supervision of the distribution of all publications sent to foreign addresses, whether to an individual or to a mailing list. A statement showing in detail the foreign mail distribution is given herewith.

Summary of foreign mail for the year ended June 30, 1913.

Division.	Packages requiring postage.			Sent through Smithsonian Institution.		Total.	
	Number.	Weight.	Postage.	Number.	Weight.	Number.	Weight.
		<i>Lbs. oz.</i>			<i>Pounds.</i>		<i>Lbs. oz.</i>
Department Library.....	15,950	5,741 4	\$459.30	1,081	869	17,031	6,610 4
Office of Experiment Stations.....	7,857	5,417 0	433.36	4,879	2,577	12,736	7,994 0
Bureau of Chemistry.....	4,689	1,191 2	95.29	2,470	1,272	7,159	2,463 2
Bureau of Entomology.....	3,805	1,635 12	130.86	1,989	1,143	5,794	2,778 12
Bureau of Animal Industry.....	3,344	1,181 6	94.51	2,280	1,199	5,624	2,380 6
Bureau of Statistics.....	3,301	560 2	44.81	118	71	3,419	631 2
Bureau of Soils.....	1,062	289 10	23.17	497	262	1,559	551 10
Bureau of Plant Industry.....	983	521 0	41.68	545	283	1,528	804 0
Forest Service.....	463	174 14	13.99	368	203	831	377 14
Office of the Secretary.....	597	191 14	15.35	202	99	799	290 14
Office of Public Roads.....	218	70 8	5.64	188	106	406	176 8
Bureau of Biological Survey.....	156	70 2	5.61	96	59	252	129 2
Division of Publications.....	12	16 4	1.30	3	2	15	18 4
Total.....	42,437	17,060 14	1,364.87	14,716	8,145	57,153	25,205 14
Total for fiscal year 1912.....	42,325	17,323 4	1,385.86	16,396	9,368	58,721	26,691 4
Total for fiscal year 1913.....	42,437	17,060 14	1,364.87	14,716	8,145	57,153	25,205 14
Decrease during fiscal year 1913.....	(1)	262 6	20.99	1,680	1,223	1,568	1,485 6

TOTAL SENT ABROAD DURING THE FISCAL YEAR 1913.

Item.	Number.	Weight.	Postage.
		<i>Lbs. oz.</i>	
Packages to which postage was affixed.....	42,437	17,060 14	1,364.87
Packages sent through the international exchange, Smithsonian Institution.....	14,716	8,145 0	(2)
Grand total.....	57,153	25,205 14	1,364.87

¹ Increase of 112 packages requiring postage.

² The Smithsonian Institution is reimbursed from the department's contingent fund at the rate of 5 cents per pound.

One of the most important branches of the work is the machine room, which maintains the stenciled mailing lists of the various bureaus, offices, and divisions that are used for mailing circulars of information and inquiry, containing 86,458 addresses, from which 2,088,792 franks and envelopes were addressed during the year.

Additions and changes on the lists necessitated the cutting of 26,449 new stencils, and 24,982 stencils were removed from the different lists in the course of the various revisions. On the folding machines were folded 2,285,910 circulars. Franks furnished by Members of Congress amounting to 651,150 were cut, in addition to 1,058,735 sheets of paper, an increase of more than 10 per cent over like work accomplished last year. The greatest increase in the work of the machine room was in the duplicating of forms, circular letters, advance Notices of Judgments, press notices, and news letters. During the fiscal year 1,761 distinct and separate requisitions for flexotype work were completed, the aggregate pages of which amounted to 2,308,004, while the total number of copies of matter duplicated amounted to 1,824,089.

In addition to arranging for transmission of all addresses sent to the Public Printer for adding, dropping, or changing on the stencils maintained in the office of the Superintendent of Documents, the following miscellaneous work was performed: Addresses written for other offices in the department, 467,251; pasting Congressional franks on envelopes, 128,083; folded, filled, and mailed 1,410,372 publications in the first quarter of the fiscal year; lists of Farmers' Bulletins counted, 30,000; gathering and arranging Notices of Judgment for binding, four sets of 525 copies each, Nos. 1751 to 2250, inclusive; Notices of Judgment gathered, collated, inclosed in envelopes, and mailed, 23,636.

Since October 1, 1912, all publications for use of the department have been handled in what was formerly the miscellaneous folding room. The mailing of such printed matter as the law permits this department to do is done in this room. Here all department orders are filled. From July 1, 1912, to June 30, 1913, 136,586 press notices were mailed and also nearly 6,000,000 miscellaneous publications.

REPORT OF THE CHIEF OF THE BUREAU OF STATISTICS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF STATISTICS,
Washington, D. C., July 1, 1913.

SIR: I have the honor to submit herewith the report of the Bureau of Statistics for the fiscal year ended June 30, 1913.

Very respectfully,

NAT C. MURRAY,
Acting Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

MONTHLY CROP REPORTS.

The most important and the principal work of the Bureau of Statistics was, as heretofore, connected with the preparation of monthly crop reports.

These reports covered nearly 50 separate vegetable products and classes of live stock. Some products, however, were treated in much more detail than others; for instance, the report on the corn crop included the acreage in July, condition in July, August, September, and October, production in bushels, and quality in November; stock carried on farms in March and November; average price paid to producers on the first of each month, and a final estimate of acreage, production, and value in December. Of timothy hay, however, only a report as to the condition of the growing crop on July 1 and August 1 was made.

The scope of monthly crop reports has not been modified materially during the year under review. The work involved in the preparation of these reports is shown in compact form in the following tabulation, which gives the names of all products, and classes of live stock, investigated; and, under columns headed by the different months, letters described by a key, indicating the various subjects of investigation.

No change of importance was made in the method of preparing crop reports. The information upon which reports were based was collected mainly from four separate sources: (a) A corps of about 30,000 township voluntary correspondents; (b) a corps of about 2,800 voluntary county correspondents; (c) a corps of State statistical agents, one for each State, each of whom maintains a corps of voluntary correspondents who report to him, the total number of such correspondents in the United States being about 14,000; and (d) a corps of special field agents, each representing a district comprising generally two or three States, there being 20 such districts in the United States.

Table showing the scope of the work involved in the preparation of the several crop reports.

Key: (A) Acreage; (%a) acreage in per cent of last year; (b) number of breeding sows compared with last year; (c) condition; (d) losses from disease; (e) losses from exposure; (F) final estimates; (f) per cent of crop shipped out of county where grown; (h) number stock hogs compared with year ago; (m) per cent of crop of merchantable quality; (n) number; (P) production; (%p) per cent of full crop produced; (q) quality; (r) acreage remaining after abandonment; (s) supplies on farms; (v) values; prices of products marked (v+) in January are asked each month; (w) weight per bushel—or fleece; (Y) yield per acre.]

Crop.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Cereals:											
Barley.....	v+	sf			Ac	c	c	c	Pq	w	F
Buckwheat.....	v+					Ac	Ac	c	c	Pq	F
Corn.....	v+	sfm				Ac	c	c	c	sPq	F
Oats.....	v+	sf			Ac	c	sc	c	Pq	w	F
Rice.....						Ac	c	c	c		F
Rye.....	v+		e	re	c	c	APq				AcF
Wheat (all).....	v+	sf				s				w	F
Wheat (spring).....					Ac	c	c	c	Pq	w	AcF
Wheat (winter).....			c	re	c	c	Pq				
Forages (grasses):											
Alfalfa.....					c	c	c	%p			
Alfalfa seed.....					c	c	c	%p	Y%p		
Bluegrass (seed).....					c	c	c	c	%p		
Canadian peas.....					c	c	c	c	%p		
Clover, hay.....					%ac		Y%pq				
Clover seed.....						c	c	%ac	c	Y%p	
Cowpeas.....						c	c	c	c	%p	
Hay (all).....	v+			s	c	c	Ac	Pq			F
Kafir corn.....						c	c	c	%p	%p	
Meadows.....				c							
Millet.....				c	c	c	c	c	%p		
Pastures.....				c	c	c	c	c			
Timothy.....						c	c				
Fruits:											
Apples.....					c	c	c	c	c	%pq	
Blackberries.....					c	c	%p				
Cantaloupes.....					c	c	c	%p			
Cranberries.....								c	c	Y%pq	
Grapes.....						c	c	c	c	%pq	
Lemons.....						c	c	c	c	c	%p
Oranges.....						c	c	c	c	c	%p
Peaches.....				c	c	c	c	%pq			
Pears.....				c	c	c	c	c	c	%pq	
Raspberries.....				c	c	c	%p				
Strawberries.....						%p					
Watermelons.....				c		c	c	%p			
Vegetables:											
Beans (dry).....						c	c	c	%p		
Beans (lima).....					c	c	c	c	%p		
Cabbages.....						c	c	c	Y%p		
Onions.....					c	c	c	c	Y%p		
Potatoes.....	v+					Ac	c	c	c	Pq	F
Sweet potatoes.....	v+					Ac	c	c	c	Pq	
Tomatoes.....						c	ac	c	%p		
Miscellaneous:											
Broom corn.....						c	c	c	Y%p		
Cotton.....	v+				Ac	c	c	c	c		rP
Flaxseed.....	v+					Ac	c	c	c	Pq	F
Hemp.....					c	c	c	c	Y%p		
Hops.....						c	c	c	Yq		
Peanuts.....						c	c	c	c	Y%pq	
Planting.....				%							
Plowing.....				%							
Sorghum.....						%ac	c	c	c	Y	
Sugar beets.....					c	c	c	c	c	c	%aYp
Sugar cane.....					%ac	c	c	c	c	c	%p
Tobacco.....						Ac	c	c	c	Pq	F
Wool.....						w					
Live stock:											
Horses.....	nv										
Mules.....	nv										
Milch cows.....	nv										
Other cattle.....	nv										
All cattle.....			dec								
Sheep.....	nv		dec								
Swine.....	nv		dec					hc			

WORK OF THE CORRESPONDENTS.

More than usual difficulty was experienced in maintaining an efficient corps of voluntary correspondents, many correspondents ceasing to report or reporting irregularly. The percentage of corre-

spondents reporting regularly, classified by length of service, compared with 1912 is shown in the following table:

Number of correspondents reporting regularly, classified by length of service.

COUNTY CORRESPONDENTS.

Length of service.	Number.		Per cent of total number.		Cumulative percentage.	
	1912	1913	1912	1913	1912	1913
46 to 50 years.....	4	1	0.1	0.0	0.1	0.0
41 to 45 years.....	12	11	.4	.4	.5	.4
36 to 40 years.....	14	15	.5	.5	1.0	.9
31 to 35 years.....	36	20	1.3	.7	2.3	1.6
26 to 30 years.....	42	43	1.5	1.5	3.8	3.1
21 to 25 years.....	60	60	2.2	2.2	6.0	5.3
16 to 20 years.....	97	81	3.5	2.9	9.5	8.2
11 to 15 years.....	322	283	11.6	10.1	21.1	18.3
6 to 10 years.....	571	503	20.6	18.0	41.7	36.3
3 to 5 years.....	708	668	25.5	23.9	67.2	60.2
1 to 2 years.....	583	550	21.0	19.6	88.2	79.8
Under 1 year.....	326	566	11.8	20.2	100.0	100.0
Total.....	2,775	2,801	100.0	100.0	100.0	100.0

TOWNSHIP CORRESPONDENTS.

26 to 30 years.....	1	0	0.0	0.0	0.0	0.0
21 to 25 years.....	10	33	.0	.1	.0	.1
16 to 20 years.....	207	1,703	.7	5.8	.7	5.9
11 to 15 years.....	4,173	3,236	14.0	11.0	14.7	16.9
6 to 10 years.....	6,868	8,243	23.0	28.0	37.7	44.9
3 to 5 years.....	9,267	6,677	31.0	22.7	68.7	67.6
1 to 2 years.....	5,166	4,782	17.3	16.2	86.0	83.8
Under 1 year.....	4,171	4,790	14.0	16.2	100.0	100.0
Total.....	29,851	29,464	100.0	100.0	100.0	100.0

In 1899, when the township list of correspondents averaged approximately 37,000, the number of reports tabulated was 35.8 per cent of the list. In the 13 years succeeding, 1900-1912, the percentages of correspondents listed reporting was as follows:

1900.....	41.6	1907.....	48.9
1901.....	50.2	1908.....	58.5
1902.....	45.5	1909.....	62.5
1903.....	44.4	1910.....	63.4
1904.....	46.4	1911.....	64.2
1905.....	48.6	1912.....	61.5
1906.....	47.4		

The following tabulation shows the average number of names on each list used for the collection of data and the number of times schedules were sent to each list and the percentages of reports received and tabulated in the bureau:

Average number of correspondents on each list and number of times used during year.

List.	Monthly average number of correspondents.	Number of times used in year.
State statistical aids.....	11,764	12
County.....	2,790	21
Township.....	29,166	15
Special price.....	6,179	12
County cotton.....	770	6
Township cotton.....	7,520	6
Individual farm.....	50,000	1
Individual farm cotton.....	6,460	2
Special cotton.....	3,834	2
Ginners.....	27,000	2
Special live stock.....	3,842	4
Live stock at market centers.....	158	2
Mills and elevators.....	7,391	4
Special potato.....	8,747	1
Special cranberry.....	182	1
Special broom corn.....	438	1
Special hops.....	216	1
Special peanuts.....	1,548	1
Special beans.....	1,129	1
Comparative price.....	2,541	1
Special tobacco.....	849	3

Percentage of list tabulated each month.

Month.	County correspondents.		Township correspondents.	
	1911-12	1912-13	1911-12	1912-13
July.....	76.2	68.9	69.5	67.3
August.....	76.7	70.6	71.3	67.6
September.....	73.2	66.0	67.5	60.6
October.....	71.0	67.1	65.4	66.5
November.....	69.7	60.8	57.2	55.8
December.....	62.5	66.3	61.9	64.1
January.....	71.3	69.0	52.2	53.3
February.....	65.8	54.9		
March.....	67.1	66.8	59.8	57.4
April.....	71.2	63.3	56.7	58.9
May.....	77.2	69.2	62.7	61.9
June.....	69.5	69.1	63.8	67.4
Average.....	71.0	66.0	62.5	61.9

MISCELLANEOUS WORK.

Miscellaneous investigations not related directly with the crop-reporting work of the bureau were conducted in the Division of Production and Distribution.

The results of an important investigation of cold-storage business made by this division was published.

Two comprehensive reports concerning the wages and the supply of farm labor were made during the year. The subject of the supply of farm labor has never heretofore been treated, even superficially, by an investigator. The wage rates of farm labor had been ascer-

tained from time to time by this bureau since 1866, and in this latest investigation the information contained in previous reports was summarized and assembled.

In consequence of frequent requests for a list of agricultural fairs and exhibitions of the United States, a substantially complete list of them was compiled, and in this list not only the name of the fair and the place where held were stated but also the time when held, the geographic area covered by the exhibit, and the time of the exhibit. The number of fairs and exhibitions in the list is 2,740.

A group of undertakings by this division comprised four circulars, relating to rice, tobacco, hops, and cotton, and presenting the results of historic research extending back as far as possible into the colonial period. The points of information embrace annual production, average yield per acre, total value of the crop at the farm, the price per unit, the exports of the domestic crop, net imports of the foreign crop, and the quantity retained and received for consumption. These four circulars contain permanent information, and there has been a steady demand for them.

The project for ascertaining the dates of seeding and harvesting throughout the United States was kept in hand during the year, with the cooperation of the Bureau of Plant Industry. Much information was collected concerning the dates of sowing and harvesting forage crops and the principal clover crops.

Another subject of investigation was the statistical position of the dairy industry in the United States, with an examination of the economic redistribution of the production of market milk and butter, due to the relative increase of urban population and to facilities for transporting and storing.

As a result of an investigation concerning special efforts of transportation companies to promote agriculture, a bulletin was issued, containing a detailed analysis of the various lines of such promotion work, a list of railroads engaged therein, statistics indicating the extent of such work, and descriptions of many of its salient features.

The second annual report of this bureau on cane sugar statistics for Louisiana and Hawaii and the annual statistical report on the United States beet-sugar industry for 1912-13 were prepared in this division. There was also compiled, as a circular, a summary of sugar statistics relating to contiguous United States and its insular possessions. Other statistical work relating to sugar consisted in gathering data for use in a revised edition of Bulletin 30 of this bureau, entitled "The International Sugar Situation."

Monthly statements of foreign trade in certain farm products were secured regularly and transmitted to the International Institute of Agriculture. A revision of tables showing international trade in important farm and forest products, 1901-1910, was completed, after painstaking examination of the foreign-trade statistics of practically all countries.

Many statistical tables for the Yearbook of 1912, a compilation of the acreage of various crops for principal countries of the world, and the revision of the figures of crop production in principal countries were performed. Considerable investigation was devoted to the subject of the agricultural element of the population of various countries for the census years for which pertinent facts were published. This investigation will be completed in the fiscal year 1914, and will

assemble substantially all of the information that has been provided in all countries concerning agriculture from an occupational point of view.

A report concerning "Systems of marketing farm products and demand for such products at trade centers" was edited, compiled, and partly written in this division. This report contains a large amount of information relating to these subjects and provides a great deal of matter for which there was a great demand.

A special investigation of agricultural credit was made in this division. Information was contributed in response to schedules sent to 9,000 country bankers, farmers, merchants, and persons of other occupations distributed throughout all parts of the United States. The result of this inquiry was unique and constituted a large contribution to this subject of recent popularity. The inquiries related to the sources and sufficiency of agricultural credit and the qualifications of farmers and farm laborers to obtain it.

The greater portion of the bureau's correspondence requiring some research among various statistical official and commercial publications of this and foreign countries is conducted in the Division of Research and Reference. In response to frequent requests, a vast amount of information is furnished, its preparation requiring expert knowledge and the expenditure of much time and labor.

REPORT OF THE LIBRARIAN.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE LIBRARIAN,
Washington, D. C., September 10, 1913.

SIR: I have the honor to submit herewith the executive report of the library for the fiscal year ended June 30, 1913.

Respectfully,

CLARIBEL R. BARNETT,
Librarian.

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

USE OF THE LIBRARY.

Books and periodicals charged by the main library and the bureau, division, and office libraries during the fiscal year 1913.

Name of library.	Number of books charged—				Number of current periodicals charged.
	To individuals.	To main library.	To branch libraries.	Total.	
Main library.....	14,966	.....	21,967	36,933	¹ 76,800
Bureau of Chemistry library.....	7,405	² 1,327	61	8,793	19,166
Bureau of Entomology library.....	3,867	.....	.....	4,050	² 515
Forest Service library.....	3,677	396	2	4,073	2,206
Bureau of Plant Industry library.....	11,662	453	132	12,247	33,311
Dairy Division library.....	2,452	56	4	2,512	8,652
	44,029	2,415	22,166	68,608	140,650

¹ Approximate figures.

² October, 1912–June, 1913.

Statistics of circulation (main library) fiscal year 1913.

Largest number of books charged on any day (Dec. 6, 1912)	203
Smallest number of books charged on any day (Aug. 3, 1912, half holiday).....	31
Largest number of books charged in any month (January, 1913)...	4,106
Smallest number of books charged in any month (August, 1912)...	2,269
Average number of books charged daily.....	121
Average number of books charged monthly.....	3,078

The statistics above given do not accurately nor adequately represent the actual use of the books. They should be regarded only as a statement of the work of the loan desks of the main library and such of the bureau, division, and office libraries as have kept records of circulation, namely, those noted in the statistical table. No statistics of the circulation of books and periodicals have been kept in the libraries of the Bureau of Biological Survey, Bureau of Statistics, Office of Experiment Stations, Office of Public Roads, and the Office of the Solicitor, all of which have collections of considerable size.

The Bureau of Animal Industry and the Bureau of Soils do not maintain libraries, as their offices are in close proximity to the main library. The figures also do not include a record of the books and current periodicals used in the main library and the bureau, division, and office libraries but not charged at the loan desks. In order, however, that such records of charges as are kept might represent with a greater degree of accuracy the actual use of the books, the statistics have been kept in more detail and with more uniformity during the past year and a half, the charges to individuals being kept separate from the charges to libraries. The sum total of the books charged to individuals by the main library and the bureau, division, and office libraries included in the above table, namely, 44,029, represents the number of books borrowed for use by individuals; the remaining charges, 22,166, represent merely the record of the books shifted from one branch of the library to another. If sent from one branch of the library to another merely for filing, the charge does not represent a use of the volume; but if sent to a bureau library to fill the request of some individual in that bureau a record of the charge to the individual is made by the bureau library in the record of charges to individuals. A large proportion of the books charged by the main library to branch libraries where statistics of circulation are not kept—for example, the libraries of the Office of Experiment Stations and the Bureau of Biological Survey—should, however, be considered as charges to individuals, as they are sent to the librarians in charge of these branches, for the use of individuals in the respective offices, and not for indefinite filing. For the reasons explained above, the use of the library as indicated by the number of charges to individuals can be regarded as only an approximate statement representing most inadequately the real use of the library, but nevertheless these statistics kept with uniformity from year to year will give some idea of the growth in the use of the library.

INTERLIBRARY LOANS.

Detailed statistics of interlibrary loans are given below. Special mention should be made of the number of books lent by this library to libraries and institutions out of the city, namely, 826, the majority of which were for the use of the State agricultural colleges and experiment stations.

Largest number of books borrowed from other libraries on any day (Dec. 6, 1912).....	43
Smallest number of books borrowed from other libraries on any day (Sept. 7, 1912).....	1
Largest number of books borrowed from other libraries in any month.....	731
Smallest number of books borrowed from other libraries in any month.....	314
Average number of books borrowed from other libraries daily....	18
Average number of books borrowed from other libraries monthly..	480
Number of books borrowed during the year from libraries outside of Washington.....	91
Number of books borrowed during the year from other libraries in Washington ¹	5, 677
Total number of books borrowed from other libraries in and out of Washington.....	5, 768

¹ As regards Washington libraries, the most frequent demands were made upon the Library of Congress and the library of the Surgeon General's office.

Detailed record of books borrowed from libraries outside of Washington.

	Number of books.
1. American Geographical Society, New York	2
2. American Museum of Natural History, New York.....	3
3. Arnold Arboretum, Jamaica Plain, Mass.....	12
4. College of Physicians, Philadelphia.....	1
5. Commercial Museum Library, Philadelphia.....	1
6. Cornell University Library, Ithaca, N. Y.....	1
7. Gray Herbarium, Cambridge, Mass.....	22
8. Harvard University Library, Cambridge, Mass.....	6
9. John Crerar Library, Chicago, Ill.....	6
10. John Donnell Smith Library, Baltimore, Md.....	2
11. Johns Hopkins University Library, Baltimore, Md.....	3
12. Lloyd Library, Cincinnati, Ohio.....	8
13. Massachusetts Horticultural Society, Boston.....	2
14. Missouri Botanical Garden, St. Louis, Mo.....	5
15. Museum of Comparative Zoology, Cambridge, Mass.....	3
16. Philadelphia College of Pharmacy.....	5
17. C. S. Plumb, Ohio State University.....	1
18. Pratt Institute Library.....	1
19. Rutgers College Library, New Brunswick, N. J.....	1
20. University of Tennessee Library.....	1
21. University of Wisconsin Library.....	2
22. Virginia Agricultural Experiment Station Library.....	3
Total.....	91

Record of books lent outside of Washington during the fiscal years 1909-1913.

States, etc.	Fiscal year.					States, etc.	Fiscal year.				
	1908-09	1909-10	1910-11	1911-12	1912-13		1908-09	1909-10	1910-11	1911-12	1912-13
Alabama.....			8			New Mexico.....					1
Alaska.....						New York.....	53	91	70	79	59
Arizona.....	13	11	5	8	7	North Carolina.....	18	38	38	25	35
Arkansas.....			2	1		North Dakota.....		2	18	4	6
California.....	1	10	8	15	19	Ohio.....	17	13	29	37	53
Colorado.....	7	4	7	15	9	Oklahoma.....					
Connecticut.....	10	41	11	12	16	Oregon.....	1	24	38	36	54
Delaware.....			5	8	11	Pennsylvania.....	33	4	3	27	34
Florida.....	81	54	36	38	27	Rhode Island.....		1			
Georgia.....	1	7	4	7	1	South Carolina.....	3		1	2	5
Idaho.....					3	South Dakota.....			1	2	
Illinois.....	11	16	11	2	6	Tennessee.....	3	9	13	9	16
Indiana.....	2	2	15	23	7	Texas.....	1	12	13	12	10
Iowa.....	2	6	13	9	36	Utah.....					
Kansas.....	1	2	2	18	8	Vermont.....	16	14	8		27
Kentucky.....		3	11	2	6	Virginia.....	28	28	15	50	52
Louisiana.....	12	13	2		5	Washington.....	1	6		13	3
Maine.....	17	9	25	4	7	West Virginia.....		2	1	14	10
Maryland.....	12	8	8	9	12	Wisconsin.....	9	4	37	32	89
Massachusetts.....	3	8	17	10	14	Wyoming.....	1	6	7		5
Michigan.....	7	8	6	20	37	Canada.....	1			11	2
Minnesota.....	9	8	5	5	2	Hawaii.....	14	3	7	1	2
Mississippi.....	2	1	8	3	4	Jamaica.....	1				
Missouri.....	4	4	1	5	17	Japan.....			1		
Montana.....	1	3	2	2	15	Mexico.....		1	2		
Nebraska.....	12	18	41	17	32	Porto Rico.....	2	52	55	33	39
Nevada.....						Total.....	416	548	613	620	826
New Hampshire.....	3		1		8						
New Jersey.....	3	2	1		1						

ACCESSIONS.

The number of books, pamphlets, and maps added to the library during the past year compared with the accessions of the three previous years is as follows:

Accessions to the library for the years 1910, 1911, 1912, and 1913.

Accessions.	1910	1911	1912	1913
Purchases:				
Volumes.....	1,454	2,030	1,552	1,321
Pamphlets.....	65	89	77	51
Maps.....	8	1		1
Photographs.....			10	
Serials and continuations.....	1,574	736	522	459
	3,101	2,856	2,161	1,832
Gifts:				
Volumes.....	488	614	907	886
Pamphlets.....	387	502	756	830
Maps.....	43	12	20	28
Continuations.....	2,728	3,463	3,560	4,425
	3,646	4,591	5,243	6,169
From binding periodicals and serials.....	1,409	1,369	1,718	1,573
Total.....	8,156	8,816	9,122	9,574

Total number of accessioned books, pamphlets, and maps, July 1, 1913..... 127,819

Total number of accessioned books, pamphlets, and maps, July 1, 1912..... 122,043

Net increase..... 5,776

The difference between the increase in the number of accessioned books, pamphlets, and maps, namely, 5,776, and the total number of accessions shown in the above table is due to the fact that the following were not accessioned (i. e., numbered with the accession stamp), unbound pamphlets of less than 25 pages, unbound serials not of sufficient size to bind separately, and volumes of periodicals in temporary binders.

The amount of money available for the purchase of books during the past year was less than in the three previous years. This was owing to the fact that it was necessary to spend \$2,147 for new shelving. Although the total number of accessions received during the year was greater than in the previous year, the increase was due to the large number of gifts received, not to the number of books purchased. It is impossible to include in the report, for lack of space, a list of the institutions, societies, and individuals which have generously presented publications to the library.

PERIODICALS AND OTHER SERIALS.

The total number of different periodicals, exclusive of annuals, received currently during the year was 2,035, of which 777 were received by purchase and 1,258 by gift. A subject list of the periodicals currently received by gift and exchange is given in the following table:

Statistics of current periodicals.¹

	Pur- chase.	Gift.	Total.		Pur- chase.	Gift.	Total.
Agriculture, United States.....	16	189	205	Printing.....	1	-----	1
Agriculture, foreign.....	21	238	259	Instruments.....	2	-----	2
Veterinary medicine.....	30	29	59	Photography.....	6	-----	6
Dairying.....	15	33	48	Physics.....	8	1	9
Poultry and pigeons.....	7	41	48	Meteorology.....	1	2	3
Live stock and meat trade.....	12	36	48	Chemistry and chemical tech- nology.....	83	17	100
Soils and fertilizers.....	2	3	5	Food.....	5	13	18
Farm implements and ma- chinery.....	3	8	11	Home economics.....	2	5	7
Moor culture and peat.....	2	2	4	Pharmacy.....	19	6	25
Agricultural products.....	28	31	59	Geology and mineralogy.....	2	6	8
Fibers and textiles.....	3	7	10	Natural history.....	18	25	43
Horticulture and landscape gardening.....	40	65	105	Zoology.....	20	9	29
Forestry and lumber.....	16	20	36	Hunting and fishing.....	8	3	11
Experiment station publica- tions (United States).....	-----	75	75	Ornithology.....	11	7	18
Experiment station publica- tions (foreign).....	1	25	26	Entomology.....	38	13	51
Law.....	9	-----	9	Beekeeping.....	5	2	7
Education.....	2	9	11	Microscopy.....	3	-----	3
Economics and sociology.....	8	10	18	Biology.....	17	4	21
Commerce and statistics.....	45	88	133	Medicine, physiology, and hygiene.....	62	54	116
Groceries.....	3	4	7	Bacteriology.....	8	1	9
Engineering.....	19	7	26	Botany.....	61	23	84
Building.....	2	-----	2	General science.....	22	50	72
Roads.....	4	2	6	Geography.....	5	5	10
Railroads.....	6	1	7	General.....	13	9	22
Manufactures.....	23	16	39	United States Government documents (periodicals).....	1	34	35
Flour and feeding stuffs, mill- ing and baking.....	9	7	16	Bibliography and library economy.....	20	16	36
Ice and refrigeration.....	1	7	8		777	1,258	2,035
Paper.....	9	-----	9				

¹ Annual reports, proceedings, and transactions not included.

In order to facilitate the circulation of some of the periodicals it was necessary to purchase 97 duplicates, making the total number of periodicals purchased 874. The number of new periodicals added during the year was 122, while 35 ceased publication or were discontinued, making the net increase over the previous year 87. The number of annual reports, transactions, and other serials of infrequent issue received during the year was 4,884, in addition to the 2,035 current periodicals.

During the 52 days of the months of April and May a daily count was kept of the current numbers of periodicals received by mail and the number returned in circulation, from which count the daily average of current periodicals received was found to be 202 and the daily average of circulation of current periodicals 256. Statistics are not kept during the whole year, but it is believed that the daily average of circulation is conservative, since the count would, without doubt, have been much larger if it had been taken during the winter months when the use of the library is greater.

CATALOGUING AND CLASSIFICATION.

There were classified and catalogued 2,207 volumes, 881 pamphlets, 6,457 continuations, and 29 maps, making a total of 9,574, an increase of 452 over the previous year. There were added to the main (dictionary) catalogue 26,304 cards, and 2,941 were withdrawn, making the net addition 23,363, a decrease of 3,834 as compared with the previous year. It is estimated that the main dictionary catalogue now contains approximately 286,000 cards.

The number of titles prepared by this library for printing by the Library of Congress in what is known as the "Agr" series, compared with the previous years, was as follows:

	1912	1913
Cards for accessions and recatalogued books.....	1,872	1,377
Cards for department publications.....	449	807
Cards for foreign agricultural periodicals.....	61	298
Total.....	2,382	2,482

The total number of titles prepared by this library since 1902, in which year the printing of cards was begun, is 22,945. For the benefit of other agricultural libraries there was given as an appendix to the annual report of this library for 1912 a complete list of the series for which this library prepares cards for printing by the Library of Congress. The number of new titles added to the list in the past year was 9, a list of which is given below:

Agrikulturwissenschaftliche gesellschaft in Finland. Abhandlungen.
 Deutsche landwirtschafts-gesellschaft. Flugschriften.
 East Indies (Dutch)—Departement van landbouw, nijverheid en handel—
 Afdeeling voor plantenziekten. Mededeelingen.
 Maine—Department of agriculture. Bulletin.
 Müller, W., and Wendt, G. von. Abhandlungen aus dem gebiete der tierhaltung.
 New York (State)—Conservation commission—Division of lands and forests.
 Bulletin.
 Philippine Islands—Bureau of forestry. Bulletin.
 South Australia—Department of agriculture and intelligence. Bulletin.
 U. S. Department of Agriculture. Report of commissioner, 1862–1886; Report of
 Secretary, 1887–1893.

The amount of uncatalogued material on hand July 1, 1913, was much less than in the three previous years. The number of uncatalogued books and pamphlets on hand July 1, 1910, was 1,739; July 1, 1911, 1,984; July 1, 1912, 722; July 1, 1913, 216.

LIBRARY PUBLICATIONS.

The publications issued by the library were the Report of the Librarian for 1912 and the Monthly Bulletin of the Library, including an index to volume 3 of the Monthly Bulletin, for the period January to December, 1912; also Bulletin No. 76 of the Library, entitled "Catalogue of the publications relating to forestry in the Library of the United States Department of Agriculture."

BINDING.

The number of books and periodicals sent to the Government bindery was 3,538, a decrease of 392 as compared with the previous year. In addition to the above books and periodicals which were permanently bound, 1,899 volumes were placed in temporary binders at the library, making a total of 5,436 books and periodicals bound, an increase of 129 over the total number of books and periodicals bound in the previous year.

DUPLICATES.

The library continued the work of listing its duplicates in order that the Library of Congress and the libraries of the State agricultural colleges and experiment stations might have the opportunity of selecting any items desired. Three typewritten lists of duplicates were sent to the above libraries during the year. The publications contained in the three lists filled approximately 550 No. 2 mail sacks, from which statement it will be possible to gain some idea of the large number of duplicates received currently by the library. The items selected from the first and second lists filled approximately 500 mail sacks. As the third list was not mailed until June 28, 1913, the work of distributing the publications has not yet been completed.

The above duplicates were for the most part State and society publications and publications of foreign governmental offices and scientific institutions, the duplication arising from the fact that such publications are in many instances sent direct to the bureaus and divisions of the department in addition to being sent to the library.

The number of duplicates received was unusually large, since many offices of the department which moved to new quarters sent to the library the accumulation of several years. Through the cooperation of the bureaus and divisions the library is constantly endeavoring to reduce unnecessary duplication in the sending of publications to the department.

In the above-mentioned duplicates are not included United States Government documents, of which the library receives a large number, since they are also frequently sent direct to the bureaus, divisions, and offices of the department, as well as to the library. These duplicates are not listed but are returned either to the offices which issued them or to the superintendent of documents.

TRANSLATING.

The number of letters translated was 98 and the number of articles 3, much less than the previous year, since the library, through the cooperation of the Bureau of Animal Industry, had the assistance of the translator of that bureau in the work of translating a large number of the letters referred to the library for translation. The letters and articles for which the library was able to furnish translations were in German, French, Spanish, Italian, Norwegian, and Swedish. The need of the library for translators with a knowledge of the Slavic and Oriental languages is increasing.

MAILING LISTS AND EXCHANGES.

As has been explained in previous reports, the library has charge of the bureau and office foreign mailing lists for publications of the department and also of certain miscellaneous foreign and domestic mailing lists. A considerable amount of time was spent in the revision of these lists. The number of addresses appearing on the various lists at the end of the year is shown in the table following.

Bureau and office lists. ¹		Foreign.	
Bureau of Animal Industry.....		2	351
Bureau of Biological Survey.....			157
Bureau of Chemistry.....			174
Foreign trade journals.....			37
Bureau of Entomology.....			177
Bureau of Plant Industry.....			73
Bureau of Soils.....			154
Bureau of Statistics.....			133
Forest Service.....			108
Office of Experiment Stations:			
Agricultural Education.....			23
Experiment Station Record.....			794
Farmers' Bulletin.....			40
Farmers' Institute.....			61
Irrigation.....			7
Nutrition.....			179
Office of Public Roads.....			83
Federal Horticultural Board:			
Miscellaneous list.....			3
Shippers' list.....			611
Miscellaneous lists. ¹		Domestic.	Foreign.
Farmers' Bulletin.....		315	81
Monthly list.....		97	957
Yearbook.....		12	211
Institutions receiving all publications of the department.....		117	41

¹ The library has no control over the lists of the bureaus and offices; that is, it can not make changes or additions in their lists without their authority; but it has direct charge of the miscellaneous lists above mentioned.

² Classified list. Not all the publications of the Bureau of Animal Industry are sent to the whole list.

The library also maintains a consolidated list, arranged geographically, of all the addresses appearing on the above lists, which list is of great service in preventing duplication and in obtaining exchanges.

BIBLIOGRAPHICAL WORK AND INDEXING.

In addition to the routine work described above, the main library and the bureau and division libraries did a considerable amount of indexing during the year and prepared a number of bibliographies in response to demands in the department and in reply to correspondence.

REPORT OF THE DIRECTOR OF THE OFFICE OF EXPERIMENT STATIONS.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., September 29, 1913.

SIR: I have the honor to present herewith the report of the Office of Experiment Stations for the fiscal year ended June 30, 1913.

Respectfully,

A. C. TRUE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.

INTRODUCTION.

The work of the office varied little in general character from that of previous years. It was, however, materially increased as a result of the growing activities of the State and insular experiment stations, the development of agricultural education in general, but especially in extension lines, and the progress of special investigations under the direction of the office in human nutrition, irrigation, and drainage. The following is a brief statement of the more important developments in these various lines of work.

RELATIONS WITH AGRICULTURAL EXPERIMENT STATIONS.

The office continued to maintain close relations with the experiment stations in the several States, conducted an inspection of their work and expenditures under the Federal (Hatch and Adams) funds, as required by law, and made the results of their labors available to both popular and technical readers. Its advice and assistance in relation to the lines of work and the personnel were sought to an increasing extent.

The advisory functions of the office increased materially with the growth of the extension enterprises in the colleges with which the stations are connected. Numerous questions regarding the proper organization of extension work and its correlation with the experimental work of the stations received attention. A considerable number of these questions directly or indirectly related to the expenditure of the Federal funds for the stations.

An unusually large number of changes occurred during the year in the directorship of the stations. These changes and the effect they

inevitably have on the efficient use of the Federal funds have called for special attention and assistance from the office. The experience of the past year indicates the need of further supervision in special cases to secure stability and protect the funds given by the Federal Government.

The stations as a rule, however, made very satisfactory progress, developed and strengthened their work along fundamental lines and enjoyed an increased measure of appreciation from the States, as evidenced by the general attitude toward them and the large appropriations granted in many cases for their use. The total income of the stations in 1912 was \$4,068,240.09, of which \$1,440,000 was received from the National Government.

A report upon the work and expenditures of the experiment stations was made to Congress as required by law.¹ This report was based, as in previous years, upon a personal inspection of the stations, participated in by four members of the office force; the annual financial statements of the stations rendered on schedules prescribed by the Secretary of Agriculture; and printed and other reports received from station officers.

The work of the office in its relations with the stations was the special duty of the director, the assistant director, Mr. W. H. Beal, Dr. W. H. Evans, and Mr. J. I. Schulte.

RELATIONS WITH INSTITUTIONS FOR AGRICULTURAL EDUCATION.

There was a continuation of the rapid development of agricultural education which has been so marked a feature of recent educational progress. This was especially apparent in the better support given to the agricultural colleges, in the establishment of additional agricultural courses in universities and colleges of private foundation, in the increasing number of States giving financial aid to secondary instruction in agriculture, in the attention given to the training of teachers of agriculture for secondary and elementary schools, in the larger attendance of students at all sorts of colleges and schools in which agriculture is well taught, and in the great popularity of certain forms of elementary instruction in agriculture, such as children's gardens in cities, boys' corn clubs, girls' garden and canning clubs, and other juvenile agricultural club work.

The office endeavored to aid, as far as its means would permit, in the organization and development of this work, particularly along the more fundamental and permanent lines, with a view to making it more effective from an educational standpoint.

AGRICULTURAL COLLEGES AND SCHOOLS.

The office aided the agricultural colleges and schools throughout the country by the collection and publication of information on the progress in agricultural education at home and abroad and on improved educational methods, by lectures and addresses, and by personal conference with educational officials and teachers.

The extent of interest in agricultural education throughout the world is indicated by the fact that there were reviewed for the Experiment Station Record 1,900 American publications and 2,000

¹ See act making appropriations for the U. S. Department of Agriculture for the fiscal year ended June 30, 1913.

foreign publications relating to the subject. Card indexes of this literature, as well as of American and foreign institutions for agricultural education and instruction in home economics, were maintained by the office.

One of the important problems which has recently developed in agricultural education is the question of the educational value of practical experience and the weight which should be given to such experience in an agricultural college course. The office, therefore, undertook during the year, as a special problem in agricultural education, in cooperation with the Association of American Agricultural Colleges and Experiment Stations, the study of what experience in agricultural practice, if any, should be insisted on by agricultural colleges as a prerequisite for admission and what experience in agricultural practice it is advisable for the agricultural colleges to attempt to give their students during a four-year course.

The work of the office in relation to agricultural colleges and schools remained in charge of Mr. D. J. Crosby, specialist in agricultural education, until his resignation, March 25, 1913. Mr. Crosby was succeeded by Mr. C. H. Lane, who has as assistants Mr. B. B. Hare, Mr. E. A. Miller, and Miss M. T. Spethmann.

FARMERS' INSTITUTES AND AGRICULTURAL EDUCATION EXTENSION.

Data respecting farmers' institutes and other forms of agricultural education extension, both in this country and abroad, were gathered and arranged for publication. Addresses were delivered before farmers' associations and at educational institutions. There was a marked increase in the distribution of printed information and in correspondence.

A large number of officials connected with farmers' institutes, extension departments in the agricultural colleges, fair associations, State libraries, railroad agricultural extension departments, State departments of agriculture, and other institutions and associations interested in agricultural extension work were visited and interviewed.

There was great activity in various forms of agricultural education extension. Special effort was made to develop some of the forms of extension work that are now in operation, to introduce new methods for use by State officials and college extension directors in disseminating agricultural information and in itinerant instruction work, and to aid in the proper organization of extension work as an integral part of the agricultural educational system of the country. With this purpose in view the office began the issuing of courses of study adapted to correspondence teaching with detailed instructions for conducting this method of extension. Investigations were conducted to ascertain the effect of extension teaching upon agricultural people and to secure data relative to the improvement of plans for buildings and grounds for local and State fair associations.

There was a large increase in requests for the assistance of the office not only from farmers' institute workers, but from agricultural colleges and other institutions carrying on various forms of agricultural education extension work. There was also an increased demand for assistance in furnishing charts, diagrams, tables, photo-

graphs, lantern slides, and other illustrative material for the use of farmers' institute and other agricultural extension lecturers. Movable schools of agriculture, as planned and outlined by the office, proved in several localities to be an extremely profitable and efficient method of instruction, and a growing interest in correspondence schools for agricultural instruction was evident. The courses of study already published for movable schools of agriculture were accordingly revised to adapt them also to the correspondence school method. The growing prominence of young people's institutes led to the preparation and publication of a bulletin on educational contests in agriculture and home economics in which 28 different subjects are dealt with, thus greatly broadening a field which, heretofore, has been confined largely to corn.

Since the farmers' institute is a form of agricultural education extension, if we add the amount given for institute work during the year by the 32 States reporting and the amount given for agricultural education extension work during the year by the 31 States and Porto Rico reporting, we will have a total of \$1,305,107.31 given for all forms of agricultural education extension during the year by only a portion of the States, and if we likewise add the number of persons reported as having been instructed under each head we will have a total of 6,207,399 persons who received agricultural instruction during the year under some form of the agricultural education extension work.

This division of the work of the office remained in charge of Mr. John Hamilton, farmers' institute specialist, and his assistant, Mr. J. M. Stedman.

PUBLICATIONS OF THE OFFICE.

The office issued 87 documents, aggregating 6,020 pages, including 22 numbers of Experiment Station Record, a general index to volumes 13 to 25 of the Record, 2 reports, 8 technical bulletins, 5 circulars, 8 farmers' bulletins, including 6 numbers of Experiment Station Work, 6 consecutively paged numbers of Experiment Station Work, 1 farmers' institute lecture, 8 publications of the insular stations, 3 Yearbook articles, 13 monthly lists of station publications, 7 separates, and 3 miscellaneous documents. This represents a slight increase over the publication work for the previous year. The number of new publications, excluding revised reprints and separates, was 70, containing 5,405 pages, as compared with 66, containing about 4,000 pages, the previous year.

The publications, as in previous years, reviewed the progress of agricultural education and research throughout the world and reported the results of special investigations in nutrition, irrigation, drainage, and agricultural education. There was little change in their general character.

A comprehensive review of scientific literature relating to agriculture was continued as heretofore in the Experiment Station Record, of which two volumes, each consisting of six monthly numbers and three abstract numbers, together with the usual author and subject indexes, were issued during the year.

The rapid growth in the number and scope of the scientific investigations of agricultural problems undertaken by this department,

the experiment stations, and research agencies in general all over the world is having its logical result in the increasing number of publications which they issue. Although the last two volumes of the Record contained abstracts of 7,969 articles, the largest number for any year, it is becoming more and more difficult with the space available to keep pace with the steadily expanding volume of the literature, and especially to meet the urgent demand from agricultural investigators, teachers, and others who use the Record for more detailed abstracts, the inclusion of the many valuable articles from the less accessible sources and languages, and the more rapid publication of abstracts.

A general index to volumes 13 to 25 was issued toward the close of the year, continuing the general index previously published for volumes 1 to 12. This index contains fully 200,000 entries and is expected to be a great convenience and timesaver to all users of the Record.

As heretofore, the editorial management of the Record was in direct charge of Dr. E. W. Allen, assistant director, with Mr. H. L. Knight as assistant editor.

Other publications of the office dealt with the work and expenditures of the State agricultural experiment stations, work of the experiment stations in Alaska, Hawaii, Porto Rico, and Guam under the direct supervision of the office, statistics of the land-grant colleges and experiment stations, the Arkansas State agricultural schools, some types of children's garden work, educational contests in agriculture and home economics, the work of the agricultural colleges in training teachers of agriculture for secondary schools, a working erosion model for schools, progress in agricultural education (and farmers' institutes) in 1911, different types of dams for irrigation reservoirs, irrigation from reservoirs in western Kansas and Oklahoma, irrigation resources of California and their utilization, possibilities and need of supplemental irrigation in humid regions, progress in drainage investigations in 1911, mutton and its value in the diet, sugar and its value as food, green vegetables and their use in the diet, and a new respiration calorimeter for use in the study of problems of vegetable physiology.

The publication work of the office, exclusive of the Experiment Station Record, was, as heretofore, in charge of Mr. W. H. Beal.

INSULAR STATIONS.

Attempts are being made to develop agriculture in Alaska, to bring about its diversification in Hawaii and Porto Rico, and to restore it to its previous importance in Guam. Satisfactory progress is reported from each station.

Every effort is being made to bring the results of the investigations to the attention of those most vitally concerned. This is done through cooperative experiments, often of the nature of demonstrations, which are carried on wherever the opportunity offers. While work of this character is made prominent, the investigations regarding fundamental principles are continued in order that new truths may be learned for future application.

The increased local interest and support that is being given the stations is very gratifying evidence of the recognition of the importance of their work. In Hawaii the legislature in its recent session appropriated \$30,000 for the coming biennium to aid in supporting and extending the cooperative and demonstration work of the stations. In Porto Rico a residence for the special agent was completed at a cost of about \$5,000, the funds for which were supplied by the legislature. This makes approximately \$25,000 appropriated for buildings for the Porto Rico station within the past three years.

The appropriations for the Alaska, Hawaii, and Porto Rico stations for the year ended June 30, 1913, were \$30,000 each, with an emergency appropriation of \$5,000 additional for Alaska. The latter was intended to be used in restoring the damage done by the volcanic eruption that took place June 6, 1912. The appropriation for the Guam station was \$15,000. These sums were supplemented by sales and other funds as follows: Alaska, \$9,144.16; Hawaii, \$14,390.46; Porto Rico, \$4,997.53; and Guam, \$127.58. The latter are under the law available for the maintenance of the stations and the extension of their work.

The administrative work of the stations in relation to this office continued to be under the charge of Dr. Walter H. Evans, while the fiscal affairs were reviewed in the division of accounts of this office.

ALASKA STATIONS.

The work outlined in previous reports has been continued as far as possible, the greatest interruption being to the live-stock experiments on Kodiak Island, which were seriously interfered with by the eruption of Mount Katmai. At Sitka horticultural investigations continue to hold precedence, as does grain growing at Fairbanks and Rampart.

Experiments with small fruits receive much attention at the Sitka station. The hybrid strawberries are being tested on a fairly large scale. The attempt to hybridize the wild strawberries of the interior has not been wholly successful. A large number of currant, raspberry, and gooseberry bushes as well as some grafted apple trees were distributed to settlers who had made application for them. The past season a larger number of apple trees bloomed and set fruit in the trial orchard at Sitka than ever before, and it is believed that some of the earlier varieties may prove adapted to the region. A very successful demonstration has been made of the value of the native crab-apple as a stock on which to graft improved varieties. About 60 varieties of potatoes were tested at Sitka and several found to produce tubers of good quality and large yield. A very successful experiment in poultry raising has been begun and the example of the station is being followed by others.

At the Rampart station most of the cereals matured in 1912. The work of hybridizing grains was continued, and four varieties of beardless barley have been produced. These were all fully ripened by the end of August. The plant-breeding work at this station has been extended to include hybridizing and pedigree breeding of oats and wheat and a number of strains of alfalfa which were introduced from Minnesota, South Dakota, and elsewhere. These have withstood three winters, and some, especially the Grimm variety, have made

splendid growth. Attention is now being given to the seed habit of the plants in order to select strains that will produce seed in Alaska.

At the Fairbanks station, where farming on an extensive scale is being tried, a most successful season was reported. Practically all cereals ripened their entire crop. Spring wheat, winter rye, barley, and oats all grew well, ripened, and produced large yields. To care for the increasing crop a small thrashing machine, the first to be used in Alaska, was purchased and sent to Fairbanks. Considerable grain hay was produced, more than 30 tons of oat and barley hay being cut from 22 acres. The potato crop for 1912 was one of the largest ever harvested at Fairbanks station. On slightly more than 5 acres nearly 1,200 bushels of marketable potatoes were produced and about 160 bushels of small tubers used for stock feed.

Following the eruption of Mount Katmai in June, 1912, the Gallo-way cattle were removed from the reservation on Kodiak Island, the grades and old animals sold, and the remainder taken to the State of Washington for pasturing and wintering. Preliminary experiments showed that the ash contained no deleterious substances, but when mixed with soil or fertilizer produced good crops. Early in the spring of 1913, 30 tons of lime nitrogen and about 5 tons of oats and grass seed of various kinds were sent to Kodiak and used to reseed areas where the native grasses were too deeply covered to come through the ash. The superintendent reports the experiment as progressing very satisfactorily. As soon as sufficient pasture and forage is provided the cattle will be returned to Kodiak, where the breeding and dairy work will be resumed.

HAWAII STATION.

The work of the Hawaii station for the diversification of agriculture in those islands has continued uninterruptedly. Some of the investigations begun several years ago are being brought to a conclusion and new ones begun. The entomologist devoted much of his time to studies of the insect pests of tobacco and vegetables, the biology of bees in Hawaii, and to the breeding and distribution of parasites of the Mediterranean fruit fly.

As a result of investigations during several years it has been found possible to breed a strain of papayas, 92 per cent of which are fruit bearing, thus making it possible to do away with the fruitless staminate plants. Grafting papayas has been found not only very easy, but of considerable value in propagating desirable strains. Some preliminary work has shown that the shape of the pineapple fruit is subject to the laws of heredity, and experiments are in progress to develop a cylindrical fruit for canning purposes and thus avoid some of the loss due to the use of conical fruits.

The soil survey of Hawaii is nearing completion. Many soils of unusual physical and chemical properties have been found and their origin from lavas has been traced. Continued studies have been made of the latex of *Euphorbia lorifolia*, the discovery of which was reported a year ago, and it seems probable that the gathering of this new product will develop into an important industry. A series of experiments has shown that the pineapple juice wasted in canning processes may be readily converted within 24 hours into a vinegar containing 3.5 to 4.5 per cent of acetic acid.

The agronomist has devoted his attention chiefly to studies of forage crops for the Territory and methods of increasing the quantities produced. As a result of station investigations a number of silos were erected in different parts of the islands during the year and others are in course of construction.

It has been shown that kukui nuts have a value of at least 1½ cents a pound for oil and fertilizer, and several firms are preparing to collect the nuts and produce the oil. The development of the algaroba bean meal industry is proceeding rapidly, and recently a number of contracts were let for gathering the beans on public and private lands. The use of the meal has been included in the ration for Army horses in Hawaii. Dynamite has been satisfactorily employed for loosening the soil and providing drainage in pineapple fields and rubber plantations.

Considerable cooperative demonstration work has been carried on, financed largely by funds provided by the Territorial legislature. Six substations have been established on different islands. The influence of these demonstration farms is already evident in the improved conditions observed in the neighborhood. Some attention is being given to cooperative marketing, and under the guidance of the station six associations have been organized, and it is planned to bring them and others under one head at Honolulu. This work is wholly supported by the Territory and it will be extended as rapidly as possible.

PORTO RICO STATION.

In order to assist in the general problem of improving the condition of the island's population, the station is giving especial attention to the utilization of waste lands, or those which are unprofitable under the present systems of cultivation. Formerly many of these lands were fertile, but their forest cover has been cut off, and under the influence of leaching and eroding rains and the tropical sun they have become almost or quite sterile. To bring these lands back to profitable cultivation, a beginning is made by growing legumes, such as beans and peas. In this campaign the station distributes without charge to those who will follow directions large numbers of seeds, plants, and trees. In different sections of the island cooperative experiments in growing forage plants, especially leguminous ones, are in progress, the station furnishing the seed and taking whatever data are desired.

The chemical department of the station is conducting experiments on the fertilizer requirements of various soils and crops. The work on the influence of fertilizers on the yield, quality, and shipping character of citrus fruits is being carried on in cooperation with various growers. Fertilizer experiments with coconuts have already given evidence of increased production. Experiments on chlorosis of pineapples, sugar cane, and other plants are in progress to secure practical methods of control. An extensive study of the red clay soils of Porto Rico has been completed.

The station is continuing its efforts to aid in the development of the citrus industry of Porto Rico, which in 10 years has grown in exports from a value of \$230,000 to more than \$1,100,000 in 1912. Some of the introduced varieties of mango are quite promising. The

work with coffee continues to receive much attention. It has been shown that by better methods of cultivation and fertilizing the crop can be more than doubled. A number of excellent varieties of coffee introduced by the station yield more abundantly than the ordinary varieties. Large amounts of seed of these varieties have been distributed for planting, and the hardiness of some has led to their recommendation for planting in exposed and denuded situations. The work begun with vanilla has given such excellent results that the growing of vanilla as a new industry in Porto Rico seems assured. Experiments in growing and tapping rubber trees are in progress.

Investigations of the banana disease, that is causing so much loss in parts of the West Indies and Central America, have shown that with the adoption of proper methods bananas can be grown for a number of years on the same land without serious depreciation in the crop. The relation of gummosis of citrus trees to fertilizers and the various host plants of the fungus causing the scab on citrus fruits are being studied, and the results tend to show that at least some of the suspected fertilizers are without effect in producing gummosis.

The live-stock work consists largely in the introduction, breeding, and selling at reasonable prices of poultry, horses, and cattle. A study is being made of the stock industry of the island with especial reference to soil types to determine what influence limestone soils have on stock development. Some of the lately introduced grasses and other forage plants appear to be very promising.

The results of the station's experiments with bees have been so satisfactory that beekeeping as an industry has become established on the island.

GUAM STATION.

A steadily increasing interest in the work of this station is shown through the greater number of inquiries regarding agricultural problems and the rapidly multiplying number of requests for seeds and plants not elsewhere procurable on the island. A small but convenient residence was erected during the year and also a small potting house and propagating shed. The tract of land transferred to the station by the governor has been surveyed and platted, and, while most of the land is quite rough, it can be used to advantage in connection with the live-stock work which has recently been begun.

The experiment in the improvement of the live stock of the island, including horses, cattle, pigs, and chickens, has been given much attention during the year. A survey has been made of the stock situation in order to put on record the conditions at the time the experiment was begun.

To improve the inferior native types of animals, an importation of pure-bred stock was made. Experiments are in progress in breeding these pure-bred animals to the native stock, and the practical value of these breeds as compared with native stock when kept under like conditions will be determined.

The experiments in introducing better and more productive varieties of corn are being continued, and 40 varieties from different tropical countries are under trial. Of these a hard, smooth-grained, yellow corn, obtained from St. Vincent, and a similar variety from St.

Lucia produce as good or better yields than the native type and they ripen in 30 days less time, an important consideration where two crops are grown annually.

The orchard work has been largely confined to the propagation of mango trees by inarching, the growing and distribution of better varieties of bananas, etc. Tests are in progress of a large number of tropical and subtropical fruits, vegetables, and forage plants.

The station has made quite a feature of its seed and plant distribution work and last year a considerable amount of seed which was not otherwise available and over 2,500 seedlings, rooted cuttings, and inarched plants were given away in order to encourage more general and diversified plantings.

IRRIGATION INVESTIGATIONS.

In addition to the usual irrigation work, Congress provided for a special investigation of the feasibility and economy of irrigation by the reservoir plan in western Kansas and Oklahoma. This investigation was made during the summer of 1912. The report was prepared and submitted to Congress and was published as a Senate document.¹

The special investigation of the irrigation resources of California, made under a cooperative agreement with the California Conservation Commission, was completed and reports published by both the department and the State. This investigation covered the extent and location of the agricultural lands of the State and of the irrigated lands, the water supply available for irrigation, and the possibility of extending the irrigated area. An important feature of the report is a series of maps showing the agricultural and irrigated lands of the State and the principal canal systems.

Extensive hydraulic investigations to determine the accuracy of devices for measuring water and of formulas for computing the discharge of conduits were begun and will be continued during the current year. For this purpose a hydraulic laboratory has been installed in cooperation with the Colorado Agricultural College at Fort Collins, Colo., and extensive field investigations are being carried on.

The studies of use of water, methods of using water, pumping water for irrigation, general irrigation engineering subjects, irrigation of rice, irrigation in humid sections, and the organization and operation of irrigation enterprises were continued.

In cooperation with the State Land Board of Idaho, this division has been carrying on a most comprehensive investigation of the "duty of water" in that State. This work is resulting in a much better understanding of the water requirements of crops under field conditions, and in a consequent saving of water.

In addition to field tests of pumping plants for the purpose of adapting them to irrigation work, preparation has been made in cooperation with the New Mexico Experiment Station for laboratory tests of pumps of different designs, for the purpose of working out improvement in design and manufacture.

For two years the greater part of the work in the rice districts has been done in Arkansas. One of the serious difficulties in growing

¹ U. S. Senate, 62d Cong., 3d sess., Doc. 1021.

rice in that section was the prevalence of a so-called "blight," which caused the heads to fail to fill. Investigation showed that this trouble was due to the practice of holding the water on the rice fields during the entire period of growth, and that if the water is withdrawn from the fields just before the rice begins to joint the heads will fill properly. Rice growers who have followed the advice to withdraw the water have had little trouble, and the rice crops of Arkansas have been greatly improved in this way. Beginning with the season of 1913, the principal rice investigations have been transferred to the black prairie lands of the Texas coastal plains, where the presence of salt in the water used for rice irrigation is often a menace to the crop. In order to determine what degrees of salinity in the water are allowable under various conditions, experiments in which salt water is used are being conducted. Other features of rice irrigation in this section are also being studied.

Within the last few years there has been great difficulty in securing capital for the construction of new irrigation works, and the division has undertaken investigations of operations under State irrigation district laws and the Federal Carey Act—laws enacted for the direct purpose of aiding in financing irrigation construction. These studies are not yet completed. A study is also being made of the organization and operation of cooperative irrigation enterprises. This is the most common form of organization for controlling and operating completed irrigation works, and it is believed that these organizations will furnish valuable lessons for those who wish to cooperate in other agricultural lines.

Much of the time of the men engaged in the general lines of investigation is devoted to giving advice to farmers as to the best methods of preparing land for irrigation and of conveying and using water. This is particularly true of the humid section, where the recent dry seasons have created a large demand for information as to methods of obtaining water for irrigation and of applying it to crops.

The irrigation investigations remained in direct charge of Dr. Samuel Fortier.

DRAINAGE INVESTIGATIONS.

The entire time of 25 commissioned engineers has been devoted to the work in the field and the office, assisting individuals and communities in the solution of drainage difficulties and studying the technical problems of reclaiming lands injured directly or indirectly by excess water. The scope of the work has included plans for the improvement of farm lands which may already be cultivated, but inefficiently; the reclamation of lands permanently too wet for cultivation; the protection of lands from the overflow of streams; and the drainage of water-logged and alkaline tracts in the irrigated region.

The interest in tile drainage for farm lands is increasing very noticeably in the South. This has been brought about by the uniform success that has followed the installation of well-designed and properly constructed tile drainage systems. North Carolina has been especially active in tile drainage recently, as is evidenced by the large number of requests for assistance in such work received by the office from that State. Alabama, Arkansas, and Mississippi have also

indicated an increased interest in this form of farm improvement. In all, surveys were made and plans prepared for the drainage of about 36 separate farms in the humid region, and instruction was given in construction work on several of these projects. Demonstrations of tile drainage construction methods were made to four gatherings of farmers in North Carolina.

A special line of investigation taken up was the study of excavating machinery, especially of machines suitable for the construction of small ditches. There is a great demand for a practical and economical excavator that will construct trenches for tile drains in wet soils and ditches of smaller cross section than is practicable with a dipper dredge.

The drainage survey of Jefferson County, Tex., has been completed, and a full report is in course of preparation, which will divide the 610,000 acres of swamp and overflowed land into proper drainage units, and will present plans for a complete system of levees and ditches to protect and drain the county. A survey has been undertaken of the overflowed lands along the Big Black River in Mississippi, where it is proposed to reclaim approximately 150,000 acres of flat bottom land. Surveys and plans have also been made for 70,000 acres on Black and Boggy swamps, in Hampton County, and 20,000 acres on Buck Creek, in Horry County, S. C.; for 22,000 acres in the Astoria drainage district, Ware County, and 32,500 acres on Little Satilla River and Big Red Cap Swamp, in Glynn and Camden Counties, Ga.; and for 5,000 acres on Bitter Creek, in Kay County, Okla. Inspection has been made of about 50 other areas in the humid region needing drainage and brief reports prepared outlining the reclamation work that would be expedient.

The continuation of the investigations in the wet prairie lands of southern Louisiana has been a feature of the year's work. Run-off investigations were started at 6 new stations, making a total of 10 stations now under continuous observation. A preliminary compilation of run-off data was made and was distributed among engineers and others interested in the reclamation of these lands. Studies of pumping-plant operation were begun, with the purpose of determining which types of machinery will give the most efficient and reliable service. Gaging stations have been established and measurements of run-off have been made, especially in Mississippi, Arkansas, and Georgia, to determine the maximum rate at which flood water must be removed from drained areas to prevent injury. Data are being gathered relative to the methods and cost of keeping drainage ditches in proper condition, and for determining the proper values of certain coefficients in formulas used in computing the capacities of water channels.

In the irrigated section work was carried on along the same lines as in the past.

Surveys and plans have been prepared for the drainage of more than 30 tracts of irrigated land; assistance has been rendered in solving unusual construction problems; and aid has been given in the organization of a number of drainage districts under the State laws. Lines of observation wells have been established across the Pecos Valley in New Mexico for a study of the ground water varia-

tions in connection with drainage. Investigations have been started for determining the relation between the amount of irrigation water applied and the amount of drainage water that should be removed; the efficacy of drainage for removing the injurious salts from the soil; the influence of the position of the ground water upon the appearance of "rosette" in orchards, and the relative cost of tile and open drains.

Mr. S. H. McCrory succeeded Mr. C. G. Elliott as chief of drainage investigations during the year.

NUTRITION INVESTIGATIONS.

The office continued the study of the relative nutritive value of agricultural products used as human food, with such extensions and development of the work as have been possible.

Studies of the culinary properties of food and its preparation for the table have been continued, particularly with corn meal.

Experimental studies have been initiated of the culinary and table qualities of honey and the ways of using it as an article of diet, as well as similar work with Kafir corn, and facts of interest are being accumulated regarding these foods which will aid the housekeeper as well as the producer.

In cooperation with the Bureau of Animal Industry work undertaken to determine the digestibility and nutritive value of meats and culinary fats was continued.

At the request of the War Department investigations were continued and completed on emergency rations for use in the United States Army. As a result of the work the Commissary General has decided to discontinue the use of the ration under investigation and has asked for further cooperation in an effort to devise a more suitable emergency ration.

At the request of the Smithsonian Institution studies were undertaken of the nutritive value and digestibility of a special meat product. The work was completed and a report submitted.

In the various studies of the nutritive value of agricultural food products the large respiration calorimeter has been used as heretofore. Some further improvements in this apparatus and its operation have been introduced.

Studies of the ripening of fruit have been carried on in cooperation with the Bureau of Chemistry, using the respiration calorimeter especially devised for the purpose. The gaseous exchange and energy output of bananas and pineapples have been measured during the ripening period, and facts of commercial as well as of scientific importance are being accumulated, this new line of research being very promising.

The laboratory equipment has been increased by the construction of a microrespiration calorimeter which permits the study of the energy output and the gaseous exchange of material in small quantities. The preliminary work undertaken has had to do with the ripening of strawberries and has been sufficient in extent to demonstrate that it is of general use in agricultural research and of value for nutrition studies and for cooperative work with other bureaus on many lines.

Collecting and editing data on food and nutrition topics have been continued as heretofore as well as the general work on the preparation of material for publication. Each year an increasing amount of time is required by the correspondence with housekeepers and teachers who turn to the department for information and suggestions.

The nutrition investigations were, as in previous years, in charge of Dr. C. F. Langworthy.

REPORT OF THE DIRECTOR OF THE OFFICE OF PUBLIC ROADS.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF PUBLIC ROADS,
Washington, D. C., August 30, 1913.

SIR: I have the honor to submit herewith the report of the Office of Public Roads for the fiscal year ended June 30, 1913.

Respectfully,

L. W. PAGE, *Director.*

Hon. D. F. HOUSTON,
Secretary of Agriculture.

WORK OF THE YEAR.

The Office of Public Roads continued to build object-lesson roads, and also constructed three experimental roads and conducted experiments on one other. The office built 440,898 square yards of roadway as object-lesson roads and 59,130 square yards as experimental roads, a total of 500,028 square yards, which is equivalent to about 61 miles of 14-foot road. The total cost of the material and labor of all object-lesson roads was \$92,151.¹

Inspection has been made by engineers of the office on three of the previously constructed object-lesson roads to determine their condition, maintenance, and the service which they perform. Inspections have also been made of 14 object-lesson roads under progress at the time of the inspections, and 5 preliminary inspections were made of proposed work.

The office has supplied advice, through its engineers and experts, for systems of roads in three different counties. This work involves a study of all questions dealing with the road situation, such as the existing and proposed location of roads, materials and methods of construction, maintenance, and administration. Detailed reports are submitted by the engineers to the local authorities and contain all the information necessary for future road work.

For the purpose of giving proper advice and instructions on specific road problems 59 assignments of engineers, experts, and chemists were made in 23 States.

¹ These roads are described in complete detail in the bulletin entitled "Object-Lesson and Experimental Roads and Bridge Construction, 1912-13." Copies may be obtained by applying to the Secretary of Agriculture, Washington, D. C.

Eight hundred and thirty-nine samples of road materials were received and tested in the physical, chemical, and petrographic laboratories. These materials included 638 samples of various rocks and gravel and 201 samples of oils, asphalts, tars, and other bituminous materials.

Very important experiments have also been conducted with concrete and reinforced concrete with reference to their application to road building and bridge construction. The investigations concerning the expansion and contraction of concrete have been continued and have been used in an experimental concrete road.

In addition to the routine tests of the chemical laboratory, research work has been conducted upon the effect of exposure on bitumens, and tests for determining the amounts of petroleum in tars have been in progress.

In the petrographic laboratory quantitative analyses of 95 rock samples and qualitative analyses of 33 samples, together with chemical and mineralogical analyses of 373 samples, have been made.

Economic investigations for the purpose of obtaining reliable information concerning the benefits of improved roads were made in nine counties in different parts of the United States. This work will be continued in the future largely in connection with the expenditure of money appropriated by Congress for the construction of post roads. The investigation for the purpose of determining the amount of bonds issued for road building in various counties and towns of the United States is nearly completed.

Maintenance experiments have been conducted during the past year in Montgomery County, Md., on 11 types of bituminous-macadam road built in 1911-12 near Chevy Chase and in Alexandria County, Va., on approximately 9 miles of road near Arlington.

Collaborators have now been appointed in 47 States of the Union. They are required to report at least on the first of every month and are frequently called upon for additional information at other times.

The policy of cooperation with railroads in running road improvement and agricultural trains has been continued as in the past. These trains are equipped with lecture and exhibit cars, and models are supplied from this office. The models are constructed to represent standard types of road and bridge construction, and many new ones have been added during the year.

The total number of addresses and lectures delivered by representatives of this office is smaller than that of last year. In all 558 lectures and addresses were delivered by 29 representatives of the office, as compared with 1,139 in 1912 and 723 in 1911. The total attendance of meetings during the past year was 95,948, as compared with 208,472 in 1912.

A statement of the various kinds of work performed by the office follows.

ENGINEERING WORK.

The engineering work of the office is in the general charge of the chief engineer, Vernon M. Peirce, and includes object-lesson roads, experimental roads, highway bridges and culverts, county road systems, special inspections and advice, post-road construction, and instruction in highway engineering.

OBJECT-LESSON AND EXPERIMENTAL ROADS.

Forty-one object-lesson roads were constructed by representatives of the office under the direct supervision of Benjamin F. Heidel, and they may be classified according to the materials of construction as follows: Two bituminous-macadam; 7 plain macadam; 4 gravel; 1 gravel-macadam; 14 sand-clay; 1 sand-gumbo; 3 shell; and 9 earth. Two roads were also begun during the past fiscal year, but as they were not completed during that period they will be described in the annual report for 1914. The total cost of the work, exclusive of salaries and expenses of engineers furnished by this office, was, as has been given above, \$92,151.

The three experimental roads consisted of work along various lines, as follows: Bituminous-concrete, bituminous-surfaced concrete, oil-cement concrete, cement concrete, brick, surface treatments, bituminous-macadam, shell, and macadam.

The following table is given to show the number of square yards of each type of object-lesson roadway constructed during the fiscal years 1905-1913 and experimental roads for 1913, inclusive:

Area, in square yards, of object-lesson roads constructed during 1905-1913, inclusive.

Material.	1905	1906	1907	1908	1909	1910	1911	1912	1913 ¹
Brick.....						526			2,055
Concrete.....						1,004			3,013
Oil-cement concrete.....							1,917		1,744
Bituminous-concrete.....									2,898
Bituminous-surfaced concrete.....									4,178
Bituminous-macadam.....						45,832	41,551	34,453	16,040
Surface treatment.....									6,386
Macadam.....	44,944	51,246	76,376	72,587	96,107	50,333	11,330	14,806	57,131
Asphalt-slag.....							578		
Oil asphalt-gravel.....							900		
Oil-gravel.....						4,819	9,774		
Gravel-macadam.....									2,607
Gravel.....	8,804	4,197	11,722	4,608	65,793	71,376	59,942	13,057	63,730
Slag.....						4,610			
Sand-clay.....	19,178	19,443	85,571	42,634	205,032	177,960	218,177	103,876	128,496
Sand-gumbo.....									5,337
Burnt-clay.....	400			3,392	2,041				
Shell.....	5,877	933		14,020	1,630				43,717
Earth.....		12,132	27,042	85,967	319,456	651,109	140,933	556,663	162,696
Total.....	79,203	87,951	200,711	223,208	690,059	1,007,569	485,102	722,855	500,028

¹ Includes experimental roads.

HIGHWAY BRIDGES AND CULVERTS.

A number of typical designs for both concrete and steel bridges were prepared by the engineer in charge of this work, Charles H. Moorefield. The concrete designs range from 2 feet to 16 feet in span, while those for steel structures range in span from 30 feet to 150 feet. Copies of these designs are furnished, upon proper application, to local road officials for use at specific points. About 350 blue-print copies have already been furnished from these plans. In addition to the typical designs mentioned above, a number of special designs for both steel and concrete structures were prepared to cover cases for which the typical designs could not be used. These special designs were distributed by States as follows: Arizona, 1; Florida,

1; Iowa, 3; Kentucky, 7; Maryland, 4; Mississippi, 6; Nebraska, 2; North Dakota, 1; South Carolina, 2; Virginia, 1; and Wisconsin, 1.

Bridge inspections were made during the year as follows: Arizona, 1; Arkansas, 1; Iowa, 10; Kentucky, 9; Maryland, 3; Mississippi, 3; North Carolina, 4; South Carolina, 2; Virginia, 1; and Wisconsin, 1. In connection with these inspections not only were the local officials advised concerning the most practical types of bridges for the various locations, but in nearly every case the advantages of employing a competent engineer to supervise all bridge work were pointed out. It is believed that a lack of proper engineering supervision has been responsible for much of the unsatisfactory work which has been done in the past, especially in connection with the smaller bridges, and the policy of this office has, therefore, been to encourage local highway officials to adopt more businesslike and scientific methods in planning and contracting for all such structures.

Besides the bridges and culverts which were constructed in connection with object-lesson roads, only one separate bridge-construction project intended as an object lesson was supervised during the year.

COUNTY ROAD SYSTEMS.

From August 24 to November 23, 1912, an engineer of the office and an assistant were stationed at Natchez, Miss., in Adams County, for the purpose of devising a county system of roads, making the necessary surveys for relocation, investigating materials, designing road structures, and advising the county officials regarding the best methods of construction, administration, and maintenance for a system of approximately 120 miles of road. It was not necessary to investigate in detail the distribution of population, cultivated area, etc., for the purpose of determining the most needed roads, inasmuch as the selection of roads had already been made by the county authorities and was not susceptible of change. The work of the office was completed, with estimates and specifications, so that the entire work was ready for advertisement when the engineer was withdrawn. Large sections of this county are covered with loess deposits and present a peculiar problem in highway construction.

Particular attention was given to the investigation and inspection of existing bridges, which were found to be generally in bad condition. Inferior bridges have been sold to the county and erected repeatedly, and ways were indicated by which the county may protect itself in this respect. The estimates cover construction amounting to approximately \$126,000 on about 120 miles of road. The design called for 24-foot clear width, 14-foot gravel surface, and a maximum grade of 5 per cent.

In October, 1912, an engineer of this office made a study of the road situation in Nueces County, Tex., with a view to designing a system of roads for that county. The study involved consideration of the farm area, productive crops, distribution of population, and other elements affecting the selection of highways for improvement, and a report was submitted to the commissioners' court, accompanied by a map showing the proposed roads to be improved, and giving complete specifications for the construction of sand-clay and gravel roads.

An engineer was detailed to Smith County, Tex., from November 7 to December 10, 1912, for the purpose of making a study for a road system for the county. The inspection covered approximately 120 miles of road and included the investigation of the road-building materials throughout the county. Tests were made in this office of all materials considered as probably satisfactory, and a report was made to the county which included an estimate and specifications for the construction of 120 miles of road, at a probable cost of \$232,581.03. With the present resources of the county it was found to be impracticable to recommend the construction of stone roads, and specifications and estimate contemplated the construction of graded earth and sand-clay roads only.

SPECIAL INSPECTION AND ADVICE.

Engineers have been assigned to advise with local officials on the various phases of road work. Under this arrangement 23 States have derived the benefit of consultation with engineers, experts, and chemists of the office. Such assignments have been made as follows among the several States: Arizona, 1; Arkansas, 4; Connecticut, 3; Florida, 3; Georgia, 1; Illinois, 1; Indiana, 3; Maine, 1; Maryland, 3; Massachusetts, 1; Mississippi, 6; Missouri, 2; New Hampshire, 1; New York, 1; North Carolina, 6; Ohio, 1; Oklahoma, 1; South Carolina, 2; Tennessee, 1; Texas, 6; Utah, 1; Vermont, 7; and Virginia, 3.

During the year, in addition to the above, an engineer of the office began an investigation of the roads and trails in the various national forests, with a view to recommendations for the improvement of road conditions.

POST-ROAD CONSTRUCTION.

As a result of the appropriation of \$500,000 carried by the Post Office appropriation act of August 24, 1912, a large amount of inspection work devolved upon the office for which no special appropriation was made. Under the memorandum of agreement between the Secretary of Agriculture and the Postmaster General, who were designated in the act to carry out its provisions, the Office of Public Roads, represented by E. W. James, chief inspector, undertakes to make all preliminary inspections of post roads designated for improvement, to make the necessary preliminary economic studies required to furnish the information called for by Congress, and to superintend construction of those projects approved by the Postmaster General. Under this procedure the Office of Public Roads has made 26 inspections of designated post roads in 18 different States. These inspections have covered 1,143.11 miles. The work has been done without special increase of force or appropriation.

Economic studies were made on four roads, as reported elsewhere. (cf. p. 7.) Construction has been started in Alabama and Iowa, and to these projects two superintendents of construction and three engineer students have devoted their time since June 1, 1912. A detailed progress report, as required by the act of Congress, covering post-road work, was made on August 24, 1913.

INSTRUCTION IN HIGHWAY ENGINEERING.

The office continued the policy of appointing graduates in civil engineering from the leading engineering institutions of the country to the position of civil engineer student. These appointments were made from an eligible list established by the Civil Service Commission through examination. During the year eight students were appointed, only one of whom resigned. One other engineer and one chemist resigned from the office staff during the year.

The position of civil-engineer student provides the opportunity for a post-graduate course in highway engineering. This work, which is conducted both in the field and in the laboratories of the office, consists of courses in road surveying and construction, investigations of road management and maintenance, petrographic examinations of road-building rocks, physical examinations of road materials, and the chemical examination of bituminous binders. Instruction was also given in designing highway bridges and culverts.

These courses, however, are not given without the office securing the best possible results from the services of the student engineers who take them. Meritorious work, provided, of course, that the service presents the opportunity, is rewarded by promoting the students to the grade of junior highway engineer at the end of the first year, and at the end of the second to the position of highway engineer, and ultimately to that of senior highway engineer.

The results of this project have been most gratifying. It serves to turn out each year a limited number of well-trained engineers, many of whom resign from the office to take positions in States or counties which would otherwise experience great difficulty in finding competent men.

ECONOMIC INVESTIGATIONS.

The economic and maintenance studies previously begun by this office in several counties were continued during the past fiscal year under the direction of Dr. L. I. Hewes, chief of economics and maintenance.

COUNTY INVESTIGATIONS.

Somewhat more time than previously was devoted to the study of the counties on the ground. The counties visited were Spotsylvania, Lee, Dinwiddie, and Wise Counties, Va.; Manatee County, Fla.; Russell and Dallas Counties, Ala.; Lauderdale County, Miss.; and Franklin County, N. Y. In every county the continued investigation of the results of highway improvement from bond issues shows encouraging features. Photographs were taken freely to present changed and improved conditions along the bond-built roads. In Spotsylvania County and Wise County additional bonds have been voted and a system of market roads will be extended.

Under the act of Congress of August 24, 1912, appropriating \$500,000 for post-road improvements, it became imperative for this office to institute detailed economic studies on all roads improved under the act. For this reason it will be unnecessary to add any

new counties to the list of those already studied for economic and social results. Under the post-road project preliminary studies have already been made in Lauderdale County, Ala.; Boone and Story Counties, Iowa; Leflore and Carroll Counties, Miss.; and Cumberland and Sagadahoc Counties, Me., although the work in the last two counties was not completed until July 25, 1913. Collaborators of this office are to take traffic censuses on each post road for one week prior to improvement and then at other times each year for a period of one week. For this purpose simplified traffic blanks have been printed.

Particular attention has been paid in the post-road economic investigations to determine traffic areas and the economic saving to the community by the reduction in the cost of hauling. For this purpose exhaustive investigations have been made in each case to secure, as accurately as possible, the number of tons hauled over each mile of road in the calendar year.

An extensive series of photographs, averaging not less than one each half mile, has been secured on each road. These, with suitable inscriptions, will form a part of each report. So far investigations tend to show that a very small reduction per ton-mile in the cost of hauling will pay all interest and maintenance charges, together with sinking-fund requirements, on the road investment proposed. A wagon equipped with a traction meter or dynamometer is run over each post road prior to improvement. There is automatically registered the requisite pull in pounds for a standard load on standard-tire widths throughout the entire length of the road. Further details will be published in connection with the post-road projects.

BOND-ISSUE INVESTIGATIONS.

The investigation of the total amount of highway bonds issued and outstanding in the various counties has been continued and is nearing completion. Returns indicate that upward of \$250,000,000 in highway bonds has already been voted by counties and towns alone and that the present rate of increase is between \$20,000,000 and \$30,000,000 annually. A bulletin on highway bonds, presenting all these statistics in detail, is now in preparation and will be completed at an early date.

MAINTENANCE EXPERIMENTS.

MONTGOMERY COUNTY, Md.—Under the authority conferred by the contract between the Secretary of Agriculture and the county commissioners of Montgomery County, dated July 1, 1912, and renewed on July 1, 1913, a patrolman began work on March 10, 1913, on the experimental maintenance sections of roads constructed at Chevy Chase, Md., on Connecticut Avenue. The sections in question include 11 types of bituminous macadam built in 1911-12, between Chevy Chase Circle and Bradley Lane. Bradley Lane was surface-treated with bituminous material in the fall of 1911, and the patrol also covered the experimental sections on Connecticut Avenue north of Bradley Lane built during the last fiscal year. A salary of \$60 a month is paid to the patrolman for his services

during eight hours daily, and he is given charge over 3.2 miles of the road. He is required to furnish tools and a one-horse cart, and his duties consist in keeping the road clean, repairing all damage caused by rain water, and especially damage on the bituminous surface wherever it pits or ravel, and trimming the gutters and clearing the drains. Any other work that is necessary for the strict maintenance of all sections of the road in the patrolman's charge is expected to be attended to promptly and efficiently. The work of the patrolman for the period ended June 30, 1913, is indicated by the following table:

Work of the patrolman, Montgomery County, Md. (by days), Mar. 10, 1913, to June 30, 1913.

Month:	Connecticut Avenue south of Bradley Lane.				Bradley Lane.			Connecticut Avenue north of Bradley Lane.		
	Spreading screenings.	Clearing drains.	Inspection during storms, and miscellaneous.	Patching bituminous surface.	Clearing gutters and cutting weeds.	Patching bituminous surface.	Miscellaneous repairing, washes, etc.	Clearing gutters and surface.	Repairs to embankment and concrete.	Repairing bituminous surface.
March.....	.....	3.0	2.0	.....	6.0	.....	3.0	5.0	.....	.....
April.....	¹ 3.5	.5	5.0	.....	14.0	.....	.....	3.0	.....	.....
May.....	.....	1.0	2.0	.....	7.0	4.5	.5	3.0	3.0	.....
June.....	.....	1.0	² 4.5	³ 2.0	4.5	1.0	.....	7.5	1.5	⁴ 3.0
Distributed total....	3.5	5.5	13.5	⁵ 2.0	31.5	5.5	3.5	23.5	4.5	3.0
Cost.....	\$8.09	\$12.72	\$31.22	\$4.63	\$72.84	\$12.72	\$8.09	\$54.34	\$10.41	\$6.94

¹ Indian Refining Section, 18 small cartloads of No. 2 limestone.

² Includes 2 days spent in building a concrete outlet.

³ Indian Refining Section.

⁴ Extraordinary damage from the steam roller.

⁵ Tarvia modern pavement.

ALEXANDRIA COUNTY, VA.—The contract with the board of supervisors of Alexandria County, Va., was renewed for the fiscal year 1913, with certain changes. The maintenance by patrol was transferred from the Columbia Turnpike to two other roads of equivalent mileage. These were the Hatfield Road, from near the Hatfield station, on the Falls Church electric line, to the Arlington post office, on the Columbia Turnpike—a distance of about 3,000 feet—and the Glebe Road, running from the Columbia Turnpike, west of the Arlington post office, through the village of Nauck, to the Old Factory Road, in the Jefferson Road district, and thence along the Old Factory Road to its junction with the South Mount Vernon Road, south of Fourmile Run—a distance of 2.37 miles. The portion of the Columbia Turnpike improved by State aid with gravel surface in the fall of 1911, from a point near the Arlington post office to the intersection of the Glebe Road, was retained as a portion of the demonstration maintenance section.

The total length of the roads arranged by the new contract was approximately 9 miles.

The work of the patrolman during the past fiscal year is indicated in the following table, and for purposes of comparison the corresponding summary for the fiscal year 1912 is added:

Work of road patrolman on 8 miles¹ of earth and gravel road in Alexandria County, Va. (by days).

Month.	Dragging.	Repairing, cleaning and improving ditches and under-drains.	Picking off stones.	Cutting brush, etc.	Census.	Inspection during storms.	Loading, hauling, and spreading gravel.	Miscellaneous (clearing away leaves, filling holes, repairing shoulders, shaping roadbed, etc.).
July.....	3	14	5	1			2	
August.....	1½	17	4½				1	
September.....	3½	6½	2	3		2	1	5
October.....	2	12	2				2	8
November.....	1	13½	1	1½		1		7
December.....	5	6½		1½		4	1	5
January.....	8	5	2		1	3	1	3
February.....				7		4	11	
March.....	4			8		3	5	4
April.....	3	4½	½	1	1	3	7	5
May.....	4			9	1	4	8	
June.....	1	1	1	4		1	7	10
Distributed total.....	36	80	18	36	3	25	46	47
Percentage of whole..	12.4	27.5	6.2	12.4	1.0	8.6	15.8	16.1
Cost.....	\$125.28	\$198.00	\$44.64	\$89.28	\$7.20	\$61.92	\$113.76	\$115.92

FISCAL YEAR 1912 (6½ MONTHS).

Total.....	38.5	73.0	10.5	26.5	10	5.5		6
Percentage of whole..	22.7	42.9	6.2	15.6	5.9	3.2		3.5
Cost.....	\$128.89	\$169.88	\$24.55	\$61.78	\$23.36	\$12.67		\$13.86

¹ One mile not dragged.

The average cost of dragging was \$15.66 per mile for three round trips.

In addition to the points noted in the annual report for the last fiscal year, the continued maintenance by the patrol system has demonstrated that during long dry spells it is exceedingly difficult to keep gravel sections in which considerable sand is present from rutting by motor traffic, particularly when such a road once begins to wear seriously. The reduction in the dragging cost per mile during the second year is also clearly shown. The presence of the patrolman at all times greatly improves the comfort of travel and reduces the cost of repairs by, first, the removal of all loose stones, and, second, the constant and strict maintenance of drainage features. The section of gravel road built with State aid on the Columbia Pike has responded particularly well to the patrol system and regular dragging. In fact this section has been in almost perfect condition since it was finished in the fall of 1911. The Columbia Pike, on which maintenance was discontinued, should be rebuilt with a hard surface. The western portion of this road, beyond the Arlington post office, was exceedingly rough, owing to improper repair during many years by dumping cobblestones, and dragging was of no benefit.

INVESTIGATION OF ROAD MATERIALS.

Eight hundred and thirty-nine samples of road-building materials were received for investigation in the chemical and physical laboratories. This represents an increase of 25 per cent over the number of samples received during the previous year. The materials tested consist of road-building rocks, gravel, sand, clay, marl, cement, concrete, cinders, brick, soil, slag, oils, tars, etc.

CHEMICAL INVESTIGATIONS.—The chemical and petrographic laboratories are under the supervision of Charles S. Reeve, chemist. Two hundred and twenty-one samples were submitted to the chemical laboratories for examination under the immediate supervision of the chemist, Charles S. Reeve. These included practically all the prominent types of bituminous road materials and bituminous aggregates. In addition to the above, the petrographic laboratory, in direct charge of Dr. E. C. E. Lord, petrographer, made quantitative analyses of 95 rock samples and qualitative analyses of 33, while 373 were examined chemically and mineralogically for purposes of identification. This makes an actual total of 702 samples that passed through the division of chemistry.

That the laboratory work of the office is becoming more and more appreciated is demonstrated by the fact that two colleges have during the year each sent a member of their faculty to take a thorough course of instruction, with a view to introducing similar lines of work into their curricula. Instruction was also given to six senior highway engineers of the office and six civil engineer students.

There is an unceasing demand for specifications for bituminous road materials and methods of using them, and during the year 124 specifications were issued from the laboratory.

The laboratory force cooperated with the engineering division in the investigation of the value of some Texas natural rock asphalt and also in an effort to develop some satisfactory means of utilizing bitumen in conjunction with the Florida coralline rocks. This cooperation also extends through all the regular experimental construction of the office and in the inspection of projects previously completed.

PHYSICAL TESTS.—Under the charge of Albert T. Goldbeck, the testing engineer of the office, the road-building properties were reported on 118 samples of dolomite, 96 of limestone, 70 of gravel, 41 of sandstone, 36 of sand, 19 of granite, 40 of trap rock, and on 218 miscellaneous samples, including gneiss, schist, shale, slate, etc. These samples were received from 42 States and Territories and include 12 samples from Canada. The States from which the greatest number of samples were submitted are: Wisconsin, 99; District of Columbia, 82; Pennsylvania, 75; Virginia, 65; Mississippi, 27; New York, 26; Maryland, 21; and North Carolina and Florida, 20 each.

The research investigations during the past year have been made largely with reference to concrete and reinforced concrete in their application to road building and bridge construction. An investigation of importance to the reinforced concrete designer has been partially completed and reported in a technical paper for the American Society for Testing Materials. The object of this investigation was

to determine the effective width of reinforced concrete slabs supported on two sides only and subjected to concentrated loading. Results of great interest have been obtained. The work on the expansion and contraction of concrete has been continued as in the past year, and has likewise been extended from a laboratory investigation to a field experiment on a concrete roadway. Measurements are taken under the most extreme conditions of temperature in an effort to obtain useful data for the design of expansion joints in this type of roadway.

An analysis of the several tests practiced in this laboratory to determine the wearing qualities of road-building rocks was made and presented in a paper before one of the technical societies.

A very complete description of the work of the laboratory and an analysis of the results obtained was likewise presented in a technical paper before the International Road Congress at London.

The work of giving instruction in the testing of road materials has been carried on as during past years and, not only have student engineers and senior highway engineers connected with the office received instruction in the laboratory, but, in addition, instructors from various State universities have also taken the course.

LECTURES, ADDRESSES, AND PAPERS.

During the year 558 lectures and addresses were delivered in various parts of the United States by 29 representatives of the office. In 1911, 723 lectures were delivered, and in 1912, 1,139. The total attendance this year was 95,948, while in 1912 it was 208,472. Lectures are included which were delivered in connection with road-improvement and agricultural trains.

All of the lectures were of a practical or scientific character, and most of them were illustrated with lantern slides. Besides the lectures given in connection with road-improvement trains, addresses were given at farmers' meetings and road conventions. Several papers were also read at colleges and universities, and before scientific organizations and societies. Four lectures were delivered in the Dominion of Canada by representatives of this office.

The names of the States and the number of lectures given in each are as follows: Alabama, 9; Arizona, 25; Arkansas, 19; California, 12; Connecticut, 2; District of Columbia, 7; Idaho, 14; Illinois, 21; Indiana, 26; Iowa, 30; Kansas, 32; Kentucky, 7; Maine, 2; Maryland, 6; Massachusetts, 21; Michigan, 4; Minnesota, 4; Mississippi, 22; Missouri, 53; Montana, 1; Nebraska, 3; New Hampshire, 3; New Jersey, 3; New Mexico, 26; New York, 3; North Carolina, 36; North Dakota, 1; Ohio, 5; Oklahoma, 7; Pennsylvania, 6; Rhode Island, 1; South Carolina, 4; South Dakota, 11; Tennessee, 2; Texas, 46; Utah, 3; Vermont, 50; Virginia, 11; Washington, 9; West Virginia, 14; and Wisconsin, 1.

The office does not send lecturers to any community except upon request, and not then until assured that the meeting has been properly advertised and that the attendance will justify the expense. During the year it was necessary to refuse a large number of applications for lectures.

COLLABORATORS.

During the past fiscal year the office continued its policy of collecting and keeping on file information relative to road activities in the different States. For this purpose a collaborator is maintained in all but one State to report on the first of each month on all road matters of importance that occurred during the preceding month, with such supplementary reports as the office may require from time to time. In the States having State highway departments the policy has been to appoint as collaborator some one connected with that department, and in the other States the policy has been to appoint some State official or public-spirited citizen in close touch with the road situation in the State. Frequent requests are received by the office regarding road activities in the different States, and the reports made by the collaborators, which are digested and briefed each month, have proved a valuable aid in answering this correspondence as well as in directing some of the other activities of the office.

MODELS AND EXHIBITS.

Exhibits consisting of models and enlarged photographs illustrating the best methods of road, bridge, and culvert construction, road drainage, maintenance and repair, and road-building machinery and equipment have been made during the year at various exhibitions, congresses, and fairs, and on road-improvement trains. The St. Louis & San Francisco Railroad operated a special train over its entire system for the purpose of exhibiting these models. This trip was completed on the 31st of August, 1912.

Exhibits furnished by this office were made during the year at the following places and under the auspices of the organizations named: International Dry Farming Congress, Lethbridge, Canada; United States Land Show, Chicago, Ill.; American Road Congress, Atlantic City, N. J.; American Road Builders' Congress, Cincinnati, Ohio; Indiana Good Roads Congress, Indianapolis, Ind.; Kentucky Highway Engineers' Convention, Louisville, Ky.; National Corn Exposition, Columbia, S. C.; Travel and Vacation Exhibition, New York, N. Y.; Domestic Science Exposition, New York, N. Y.; National Automobile Show, New York, N. Y.; Interstate Fair, Spokane, Wash.; Rockingham Fair, Salem, N. H.; North Carolina State Fair, Raleigh, N. C.; Ohio State Fair, Columbus, Ohio; Insular Fair, San Juan, P. R.; and Inter-Mountain Good Roads Association, Boise, Idaho.

The total estimated attendance of persons who examined the exhibits of this office at these various exhibitions was about 625,000. The cost of installation, drayage, freight, and repacking was paid by the various exhibition companies, except in the case of the exhibit at Lethbridge, Canada, where all expenses were paid out of a special fund appropriated by Congress.

PUBLICATIONS.

During the fiscal year 1912 seven publications were issued by this office. Of these, four were office bulletins, one a Farmers' Bulletin, one a circular, and the last the annual report of the office.

THE LIBRARY.

The library of this office, under the charge of W. W. Sniffin, librarian, has increased to such an extent that it was necessary to provide a 25 per cent increase in the shelving capacity. The collection of State documents, both of the United States and of foreign governments, on the subject of roads is up to date and practically complete. Publications on road conditions in France, Great Britain, and Germany, besides a number of other countries, are now to be found on the shelves.

Eighty-one periodicals are received, of which 26 are contributed by the department library and 55 are mailed directly from the publishers. All numbers of the periodicals are now being bound in temporary binders until such time as they are permanently bound or are given up to the department library for other disposition.

The library is also collecting trade catalogues of all appliances and materials dealing with road construction.

PHOTOGRAPHIC LABORATORY.

Under the direction of E. Block, photographer, the work of this laboratory during the year involved the development of 264 rolls of films and required making 247 negatives, 517 bromide enlargements, 2,187 lantern slides, 9,523 prints, and 12 transparencies. During the year 2,033 lantern slides for lecture work were colored by the artist of the office.

At the present time the office has 9,620 negatives on file, of which 1,796 were added the past fiscal year. Photographic records of all object-lesson and experimental work and of all roads on which economic studies are being made are kept on file in the office.

REPORT OF THE SOLICITOR.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SOLICITOR,
Washington, D. C., October 1, 1913.

SIR: I submit herewith the report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1913.

Very respectfully,

FRANCIS G. CAFFEY, *Solicitor.*

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

SUMMARY OF OFFICE WORK.

The work done by this office during the fiscal year 1913 covered a broad field and was diversified in character.

Frequent consultations were held with the administrative officers of the department. Aid was given them in the interpretation of statutes and regulations and in the determination of their powers and duties. Assistance was also given them in making new regulations and in the revision of existing regulations, including the fiscal regulations of the department, regulations and instructions relating to water power and telephone, telegraph, and power transmission lines in the national forests, regulations and instructions relating to the grazing of live stock on national forest lands, regulations covering the use and sale of timber in the national forests, regulations for the enforcement of the plant quarantine act, regulations governing the importation and interstate shipment of viruses, serums, and analogous products for the treatment of diseases of domestic animals, and regulations for the protection of migratory birds. Assistance was also given to the committee which revised the department's system of accounting and to the committee having in charge the adjustment of the work of the Bureau of Animal Industry and the Bureau of Chemistry affecting meat and meat-food products.

Papers, including statements of the issues, briefs, and memoranda, for submission to the Attorney General, the Secretary of the Interior, the Comptroller of the Treasury, and officers of other departments, of a large number of questions in which the Department of Agriculture was concerned were prepared in this office. Among such questions were whether the food and drugs act applies to meat and meat-food products, the validity of this department's new system of accounting, the meaning of the term "municipal purposes" in the act of February 1, 1905 (forest-transfer act), the power of the United States under the act of March 1, 1911 (Weeks

law), to take title to lands burdened with encumbrances other than mineral and timber reservations, the appropriation of water for ranger stations, the acquisition of lands for the establishment of a winter elk reserve, the purchase of supplies in the open market, the disposal of funds realized from the sales of products of experiment stations, the limitation of the appropriation of \$500,000 for cooperative road building, and the compensation of employees transferred from statutory to lump sum rolls.

Numerous bills pending before the Congress affecting the work of the Department of Agriculture, referred to this office for criticism, received attention, and drafts of new legislation were prepared at the request of committees of Congress or officials of the department.

During the latter part of the year this office considered a large number of cases involving questions of irregularity or misconduct by employees in the performance of their official duties. In each case the facts were investigated. In those cases where such action was warranted formal charges were prepared, and after the employees concerned had had full opportunity to reply, the charges, the answers, and the evidence received consideration, and the facts were reported to the Secretary for his decision.

Reports coming to the office from various sources which disclosed apparent violations of the postal laws and regulations were referred to the Post Office Department for investigation.

There was a marked increase over previous years in the numbers of violations of the 28-hour law, of the Lacey Act, and of the insecticide act reported by the department's inspectors and considered by this office. The numbers of violations of the food and drugs act, of the laws for the protection of the national forests, of the meat-inspection act, and of the animal-quarantine laws, which required action by this office, continued to be large. Consideration was given to the evidence submitted by the several bureaus tending to show violations of these statutes. Statements of the facts in the cases in which it was thought that prosecutions could be maintained were prepared for transmission to the Department of Justice. Briefs and memoranda on the legal questions involved were prepared for the Attorney General and the United States attorneys. This office complied with numerous requests of United States attorneys for assistance in the preparation and prosecution of the cases. There has been throughout the year cordial cooperation with the prosecuting officers of the Government.

The numbers of violations of the statutes intrusted to this department for enforcement, which were reported to the Department of Justice for action, were as follows: Laws for the protection of the national forests, 406; food and drugs act, 1,048; 28-hour law, 1,037; animal-quarantine acts, 92; meat-inspection law, 81; Lacey Act, 154; insecticide act, 62; miscellaneous, 8. Much time was given to cases reported by the various bureaus and not transmitted to the Department of Justice, because this office held that prosecutions could not be maintained.

In addition to reporting to the Department of Justice violations of laws for the protection of the national forests, this office, through its employees at Washington and its field assistants, performed the following work in connection with the Forest Service: Eight hundred and sixty-one written opinions were rendered to the Forest

Service on legal questions arising in connection with the administration of the forests. One thousand four hundred and twenty-six contracts, leases, bonds, and other agreements in which the Forest Service was interested were prepared or examined for their sufficiency. Consideration was given to 1,184 cases involving contested claims to lands within the forests. One hundred and fifty-nine briefs were filed in contested claims cases. Eleven appeals to the Secretary of the Interior from adverse decisions of the Commissioner of the General Land Office were prosecuted. Three oral arguments were made before the Secretary of the Interior. Depositions were taken in 173 cases. Nineteen proclamations and executive orders eliminating lands from the forests were prepared or passed on.

Two hundred and fifty-seven contracts for the purchase of lands for the protection of the watersheds of navigable streams under the Weeks law (act of Mar. 1, 1911) were prepared during the year. The record examiners in the field completed the examination of the titles to 34 separate tracts of land, comprising approximately 210,000 acres. Of these tracts, titles to 19 were approved, and proceedings for the condemnation of 15 were recommended.

In addition to contracts under the Weeks law and contracts prepared for the Forest Service, 488 contracts and leases were prepared for the several bureaus, offices, and divisions of the department. Thirteen applications for letters patent on inventions of employees of the department for dedication to the public were prepared and filed.

Notwithstanding the large volume of business transacted during the year there was no increase in the force of law clerks. The business of the office was kept current, and the several employees of the office have performed their duties creditably and expeditiously. There are being investigated certain possible duplications of legal work in which other departments are concerned, with a view either to decreasing the force in this office or to doing such new work as may result from the growth of the department's activities without increasing the force in this office.

The establishment of the Office of Markets and the Rural Organization Service promises to bring additional important legal work to this office. It is not yet apparent how extensive such new work will be or how many lawyers will be needed to handle it. If it develops that the volume of this kind of work will be considerable, it is certain that an addition to the law force will be required, unless some of the types of legal work now being done can be eliminated.

The tabulated statements which have heretofore been printed with the annual report of this office, showing in detail facts and status of the principal prosecutions originated in the department, in which United States attorneys have commenced proceedings, and of the claims and other matters affecting the administration of the national forests in which this office is concerned, are submitted herewith for your information. Much of what is contained in the statements is given publicity otherwise than through the annual report of this office. In my opinion the printing of these tabulated statements serves no useful purpose, and it is recommended that they be filed in the Office of the Secretary for reference and for use in answering such inquiries as to their subject matter as may be addressed to the department.

ADMINISTRATION OF THE ACTS OF CONGRESS.

THE FOOD AND DRUGS ACT.

LEGAL WORK.

There were transmitted to the Department of Justice recommendations in 1,048 cases under the act. In 652 of these, criminal proceedings, and in 396, seizures, under section 10 of the act, were recommended. Before transmission the cases were fully examined as to the facts and the law, and complete statements prepared for the use of the Department of Justice. Of the cases reported during the year, 528 were either pending in the courts or under consideration by the Department of Justice at the end of the year.

Of cases reported to the Department of Justice during the present year or during preceding years, 1,250 were terminated during this fiscal year; of which 848 were criminal and 402 were civil.

Of the 848 criminal cases, fines were imposed in 596; sentence was suspended in 45; in 1 the information was placed on file; in another the defendant was convicted after trial, but sentence had not been imposed at the end of the year; in 4, demurrers to the informations were sustained; in 8 there were acquittals; in 68 there were nolle prosequis; 124 were withdrawn or dismissed; and in 1 the grand jury failed to indict. In a majority of the criminal cases pleas of guilty, nolo contendere, or non vult were entered. In 25 of the cases pleas of not guilty were entered and the defendants were convicted after trial.

In the criminal cases in which convictions were obtained the fines were as follows:

Number of cases.	Amount of fine.	Total.	Number of cases.	Amount of fine.	Total.
6	\$1.00	\$6.00	43	\$100.00	\$4,300.00
19	5.00	95.00	7	125.00	125.00
1	8.50	8.50	7	150.00	1,050.00
100	10.00	1,000.00	5	200.00	1,000.00
24	15.00	360.00	1	¹ 250.00	250.00
24	20.00	480.00	2	² 400.00	800.00
167	25.00	4,175.00	1	³ 550.00	550.00
2	30.00	60.00	1	⁴ 750.00	750.00
1	34.00	34.00	1	⁵ 1,100.00	1,100.00
58	40.00	2,320.00	1	⁶ 1,200.00	1,200.00
70	50.00	3,500.00			
4	75.00	300.00	⁷ 539	.....	23,463.50

¹ In this case a prior conviction was alleged.

² In one of these cases there were 6 counts in the information involving 2 products. In the other case there were 3 counts in the indictment involving 3 products.

³ In this case there were 15 counts in the information involving 10 products, and fines were imposed in regard to 8 of the products.

⁴ In this case there were 3 counts in the indictment involving 3 products, and a second offense was alleged.

⁵ In this case there were 21 counts involving 10 products, and fines were imposed in regard to 9 of the products.

⁶ In this case there were 2 defendants, and there were 3 counts in the information. Each defendant was fined \$600.

⁷ This number represents 596 cases reported to the Department of Justice, some of which were consolidated by the United States attorneys for trial.

In addition to the fines imposed, costs were generally assessed. An appeal by the defendant is pending in 1 case.

Of the 402 civil cases terminated during the year decrees of condemnation and forfeiture were entered in 365; in 2 the libels were dismissed in the district courts; in 2, decrees of the district courts dismissing the libels were affirmed by the circuit court of appeals; in 1 a decree of condemnation and forfeiture was affirmed by the

court of appeals; in 8 libels were dismissed with the consent of the Government, and in 24 the packages were broken or disposed of before seizure could be made. In the 366 cases in which final decrees of condemnation and forfeiture were entered, including the 1 in which the decree was affirmed by the court of appeals, the goods were destroyed in 153; released on bond, conditioned that they would not be sold contrary to the provisions of the act, in 157; sold, in 56.

The cases reported during the year to the Department of Justice for action were based on shipments containing vinegar, dried fruits, canned vegetables, extracts, sirups, eggs, temperance beers, flour, wines, beers, and other alcoholic liquors, cocoa, fish, mineral waters, coffee, coconut, malt tonic, gelatin, stock feeds, cheese, oranges, cat-sups, salt, chestnuts, oysters, nuts, maraschino cherries, mushrooms, mincemeat, butter, patent medicines, candies, olive oil, and turpentine.

In addition to the cases reported by this department for action by the Department of Justice under the food and drugs act the food and drug officials of the various States and of the District of Columbia collaborating with the department in the enforcement of the act, reported 41 cases to the different United States attorneys for action. Of these 40 were criminal cases and 1 was a seizure. In all of the criminal cases there were convictions, there being a contest in only 1 case. In the seizure case a decree of condemnation and forfeiture was entered, and the product was ordered sold. The fines in such criminal cases were as follows:

Number of cases.	Amount of fine.	Total.
9	\$5.00	\$45.00
24	10.00	240.00
4	15.00	60.00
1	20.00	20.00
2	25.00	50.00
40	-----	415.00

During the year 867 Notices of Judgment were prepared in this office.

There was a large volume of correspondence between this office and the various United States attorneys in reference to pending cases. The office has frequently prepared memoranda of law and briefs for the use of prosecuting officers, and has given all the assistance requested in preparing cases for trial.

Representatives of the office have not taken part in the actual trial of cases, but arrangements have been made with the Department of Justice for members of this office hereafter to attend and participate in the trial of cases which are either of especial importance or involve very technical questions.

On June 16, 1913, rule 39 of the rules and regulations made for the enforcement of the food and drugs act was repealed. Under that rule domestic meat and meat-food products which were prepared under Federal inspection were exempted from the provisions of the food and drugs act. As a result of the repeal, the power of seizure of unsound meat and meat-food products in the course of interstate commerce can be and has been exercised. Under the meat-

inspection amendment spoiled meats could be condemned and destroyed only when they were found within establishments in which Federal inspection was maintained.

The food and drugs act was twice amended during the year.

By the so-called Sherley amendment, approved August 23, 1912 (37 Stat., 416), enacted to meet the decision of the Supreme Court in *U. S. v. Johnson* (221 U. S., 488), false and fraudulent statements as to the curative or therapeutic effects of medicines were brought within the prohibition of the law. Several cases under the amendment were reported to the Department of Justice during the year.

By the so-called Gould amendment, approved March 3, 1913 (37 Stat., 732), articles of food in package form must bear a statement showing the quantity of the contents in terms of weight, measure, or numerical count. Reasonable variations from the quantities stated on the packages may be permitted by rules and regulations made by the Secretaries of the Treasury, Agriculture, and Commerce. Tolerances and exemptions as to small packages are to be established by rules and regulations prescribed by the same officials. Advice has been given by this office to the committee having in charge the framing of such rules and regulations.

CASES OF INTEREST.

UNITED STATES V. 443 CANS OF FROZEN EGG PRODUCT, H. J. KEITH CO., CLAIMANT.

(226 U. S. 172; N. J. No. 2437; Circular 68, Office of the Solicitor.)

This case came before the Supreme Court on a writ of error to and appeal from a judgment of the Circuit Court of Appeals for the Third Circuit. The case originated by the seizure for condemnation, under section 10 of the act, of a quantity of frozen-egg product alleged to be decomposed. The District Court for the District of New Jersey found in favor of the claimant and dismissed the libel. (Notice of Judgment No. 1027.) The United States appealed. The court of appeals reversed the judgment of the district court and directed a decree of condemnation and forfeiture. (193 Fed., 589; Notice of Judgment No. 1576.) The claimant carried the case to the Supreme Court, which reversed the judgment of the circuit court of appeals and remanded the case to that court, with instructions to dismiss the appeal for want of jurisdiction. This decision is important in that it settles the controverted question as to whether cases *in rem* arising under section 10 of the food and drugs act should be reviewed on appeal or by writ of error. The Supreme Court held that such proceedings, after the filing of the libel and seizure of the goods, are common-law actions and subject to review only upon writ of error, in accordance with the rules of the common law.

LEXINGTON MILL & ELEVATOR CO. V. UNITED STATES.

(202 Fed., 615; N. J. No. 2549; Circular 71, Office of the Solicitor.)

This case involves the long-controverted questions as to whether flour bleached with nitrogen peroxide gas is adulterated and misbranded within the meaning of the food and drugs act. The Circuit Court of Appeals for the Eighth Circuit reversed a judgment in favor of the Government in the District Court for the Western District of Missouri. (Notice of Judgment No. 722.)

The case originated by the seizure of 625 sacks of flour bleached by the Alsop process. The flour was alleged to be adulterated because, as a result of such bleaching, there had been added to it certain poisonous and deleterious ingredients, known as nitrites and nitrite reacting material, which might render it injurious to health; and because nitrites and nitrite reacting material had been mixed and packed with it so as to reduce, lower, and injuriously affect its quality and strength, and had been mixed and packed with it in a manner whereby inferiority was concealed.

The flour was alleged to be misbranded because labeled "Fancy Patent. This flour is made from the first quality hard wheat," which statement was alleged to be misleading because the flour was not patent flour and was not made of first quality hard wheat.

The court of appeals, in construing paragraph 5 of section 7 of the act, in the case of food, held that in order to prove an article adulterated by reason of its containing an added poisonous or added deleterious ingredient, it is incumbent upon the Government to show that such ingredient is present in the article in sufficient quantity actually to render it injurious or deleterious to health.

The court of appeals further held that, in the absence of a fixed or universal standard for patent flour, the charge that this flour was not patent flour was not substantiated by the proof.

The Supreme Court has allowed the Government's petition for a writ of certiorari, on which the case is now pending before that court.

WILLIAM M. GALT & Co. v. UNITED STATES.

(41 Washington Law Reporter, 66; N. J. No. 2396; Circular 70, Office of the Solicitor.)

This case came before the Court of Appeals of the District of Columbia on appeal from a decree of the Supreme Court of the District of Columbia, condemning and forfeiting 447 sacks of "Princess Flour" and 72 sacks of "Fancy Melba Patent Flour" on the charge of adulteration, in that the flour consisted in whole or in part of a filthy, decomposed, and putrid animal and vegetable substance.

The claimants contended that there was no evidence in the lower court as to the condition of all the flour condemned by the decree, because out of the two lots of flour only four sacks were examined and found to be adulterated. They argued that such amount was insufficient to show the condition of all the flour seized and condemned. The court of appeals held that the question of whether a sample is fairly representative of the whole is a preliminary question to be decided by the trial court, and that the decision reached by the trial court should not be revised in an appellate court unless the facts producing the decision are before the appellate court, and then only when error clearly appears.

Another question raised was whether flour found to contain worms, insects, and beetles can be said to "consist of a filthy, decomposed, or putrid animal or vegetable substance." The claimants contended that the act makes a distinction between adulteration which consists in adding to an article that which is not properly a part of it and adulteration existing when some part of the article itself is not what it ought to be. It was contended by them that the language of the act means "when some part of the article, whether animal or vegetable, is filthy, decomposed, or putrid—not that the article contains a sub-

stance of that character foreign to its proper ingredients or constituents." The court of appeals held that it is a matter of common knowledge that the presence of the large number of worms, insects, and beetles shown by the evidence to be present in the flour would render the flour filthy in the general acceptation of that term, and that, "even conceding that the worms, insects, and beetles could be separated therefrom, the flour would still be contaminated by reason of its contact with them, and it would still contain more or less husks and excreta from the worms—that is, it would still be filthy within the meaning of the act."

DR. J. L. STEPHENS CO. V. UNITED STATES.

(N. J. No. 2511; Circular 72, Office of the Solicitor.)

In this case the Circuit Court of Appeals for the Sixth Circuit affirmed the judgment of the District Court for the Southern District of Ohio (Notice of Judgment No. 1891), directing a verdict of guilty against the Dr. J. L. Stephens Co. for violation of the food and drugs act. The defendant brought error.

The offense charged was the shipment in interstate commerce of a drug which contained morphine and alcohol without the quantity or proportion of the morphine and alcohol being stated on the labels of the bottles.

The defendant contended that the drug shipped was a physician's prescription and exempt from the operations of the food and drugs act. It was also claimed that the information was defective and insufficient because it alleged that each of the bottles shipped by the defendant was misbranded, whereas it should have alleged that the larger package, or "original unbroken package," in which the bottles were contained was misbranded.

The district court held that the word "package," as used in sections 7 and 8 of the act, is distinct from the term "original unbroken package" used elsewhere in the act; that it is to be taken in its broad sense, and means a package made up by the manufacturer for sale to the ultimate consumer; and that the bottles contained in the original package were themselves "packages," within the meaning of the act, and were misbranded. The district court also held that physicians' prescriptions are not exempt from the operations of the act.

The defendant also argued that the medicine shipped was not the subject of bargain and sale, but was a mere incident of the services rendered by a physician, and should not be treated as an article of commerce and subject to the requirements of the food and drugs act. The district court held that the sale of a physician's services included a sale of the drug, and that, as the object of the act was to keep adulterated and misbranded foods and drugs out of the channels of interstate commerce, it was immaterial whether the medicine or prescription was the mere incident of the employment of a physician or its primary object.

The circuit court of appeals affirmed the judgment of the lower court on all the foregoing questions, except as relates to the exemption of physicians' prescriptions from the operations of the act. The court declined to pass upon that question because it was not presented

in the case, in view of the fact that the medicine was not prescribed by a physician in his individual capacity in the treatment of a patient, but was prescribed by a physician who was acting for a corporation which shipped the medicine to the patient.

SCHRAUBSTADTER ET AL. V. UNITED STATES.

(199 Fed., 568.)

The plaintiff in error was convicted in the District Court for the Northern District of California (N. J., 1020) of violating the food and drugs act by shipping misbranded champagne in interstate commerce. The judgment of the lower court was affirmed by the Circuit Court of Appeals for the Ninth Circuit. The decision of the lower court holds that the term "champagne," when used alone and apart from any qualifying or descriptive words, is commonly understood to describe an effervescent or sparkling wine produced in a province of France, the gas therein being the result of natural fermentation. In this case the wine held to be misbranded was California white wine, artificially carbonated, and labeled "Extra Dry Champagne" and "Crown Brand Champagne," with certain words in French, and bore no statement on the label showing the wine to be of domestic origin. The label was held to be misleading. It was held also, on the authority of *United States v. Morgan* (222 U. S., 274), that where cases arising under section 2 of the food and drugs act originate in the United States Department of Agriculture the libel is not fatally defective for failure to allege that the provisions of section 4 relative to investigation, notice to the defendant, and opportunity to be heard have been complied with.

PHILADELPHIA PICKLING CO. V. UNITED STATES.

(202 Fed., 150; N. J. No. 2456.)

The offense charged was shipment from the State of New Jersey into the State of Pennsylvania of a quantity of adulterated tomato paste. The evidence showed that defendant shipped the product from its place of business in New Jersey to itself at its place of business in Pennsylvania. The purpose of the shipment was to have the paste tested, with a view to exporting it to England if it conformed to the English standard. The product failed to meet the test and was destroyed without having been used or sold.

The defendant contended that such a shipment did not constitute an offense within the purview of the food and drugs act, as the article was shipped to itself solely for the purpose of being tested. The District Court for the District of New Jersey held that the shipment was a shipment in interstate commerce of an adulterated article and constituted a violation of the food and drugs act. This view was upheld by the circuit court of appeals.

HALL-BAKER GRAIN CO. V. UNITED STATES.

(198 Fed., 614; N. J. No. 2702.)

The defendant was convicted in the district court of misbranding a carload of mixed wheat by selling it as "No. 2 Red Wheat,"

and of adulterating No. 2 red wheat by mixing and packing with it an inferior wheat and by substituting mixed wheat wholly or in part for No. 2 red wheat.

It was shown that the defendant received an order for No. 2 red wheat according to Missouri State inspection, and directed an elevator company to ship No. 2 red wheat. The wheat shipped was inspected by an inspector of the State of Missouri and graded as No. 2 red wheat. It was then invoiced by defendant to the consignee in Texas as No. 2 red wheat. After the receipt of the wheat in Texas it was examined and found to be mixed wheat of a grade inferior to No. 2 red wheat. The Circuit Court of Appeals for the Eighth Circuit held that the District Court for the Western District of Missouri erred in instructing the jury that it was no defense to the shipper that the State inspector graded the wheat as No. 2 red wheat; that it was also error to instruct the jury that it was no defense that the wheat had been shipped by the elevator company on the defendant's order and was not shipped by the defendant in person; also that the district court erred in instructing the jury that the certificate of inspection and the invoice of the article constituted the label thereof for the purpose of the food and drugs act.

UNITED STATES V. CHARLES G. DADE.

(N. J. No. 2516.)

The defendant was charged with selling adulterated milk in the District of Columbia. He contended that the presence of bacteria in milk does not prove that the milk "consists" in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance, for the reason that bacteria "contained" in milk are not, in themselves, filthy, decomposed, or putrid substances.

The Court of Appeals for the District of Columbia held that the case was not prosecuted on the assumption that bacteria in themselves were filthy, decomposed, or putrid, but on the assumption that the bacteria caused decomposition in the milk, and the presence of such bacteria as *B. coli* and *streptococci* indicated that the milk also contained fecal matter which rendered it filthy, and that, therefore, milk containing an excessive number of such bacteria is adulterated within the meaning of the act.

The defendant further contended that milk could not be produced which, in its raw state, did not contain bacteria, and that a limited number of bacteria in milk is practically harmless; also that certain kinds of bacteria are harmless. The court of appeals found it unnecessary to decide whether under such circumstances milk containing only a small number of bacteria could be considered adulterated, or to draw the dividing line between pure milk and impure milk, holding that each case must be decided on its merits, and that in this case adulteration was clearly established.

UNITED STATES V. J. L. HOPKINS & Co.

(199 Fed., 649; N. J. No. 2436.)

In the District Court for the Eastern District of New York, the defendant filed a plea in bar to an indictment under the food and drugs act on the ground that it was a corporation not resident in the district in which the prosecution was brought, and on the further

ground that the prosecution was barred by the laches of the Government in failing to institute proceedings "without delay," as required by section 5 of the act.

The court held that the gist of the offense under section 2 of the act is the shipment or delivery for shipment in interstate commerce of adulterated or misbranded foods or drugs, and hence that jurisdiction exists in the Federal court of the district from which the goods were shipped, even though the defendant did not reside in that district.

The court also held that violations of the food and drugs act are subject to the general statute of limitations, which is three years; that the general statute of limitations is not repealed by section 5 of the food and drugs act, which contains no specific limitation on prosecutions; and that immediate prosecution is not required by section 5 on the theory that in case of delay the right to prosecute would be barred by laches.

UNITED STATES v. D. GHIRARDELLI CO.

(N. J. No. 2238.)

In this case, confectionery labeled "Ghirardelli's Italian Chocolates D. Ghirardelli Co. San Francisco, California," contained in a box bearing the colors and design of the Italian flag, was alleged to be misbranded because it was labeled and branded so as to mislead and deceive purchasers into the belief that it was a product manufactured in Italy when not so.

The case was tried in the District Court for the Northern District of California. The court instructed the jury that in order to convict the defendant the jury must be satisfied beyond reasonable doubt that the purchaser of such an article reading the label would at once conclude that the chocolates were manufactured in Italy, and, further, that if there was any other construction to be placed upon the label the verdict must be for the defendant. The jury returned a verdict of not guilty.

UNITED STATES v. F. B. WASHBURN & Co.

(F. & D. case 2247; unreported.)

The defendant was convicted in the District Court for the District of Massachusetts of violating the food and drugs act by shipping in interstate commerce a quantity of a food product labeled "Macaroons."

The so-called "macaroons" contained about 20 per cent of glucose, and were alleged in the information to be adulterated because glucose had been mixed and packed with them so as to reduce, lower, and injuriously affect their quality and strength. They were alleged to be misbranded because the statement "Macaroons" borne on their label was false and misleading for the reason that they were not macaroons.

This case is of interest mainly because the jury found, in effect, that glucose is not a normal constituent of macaroons, and that the use of glucose in the manufacture of a product purporting to be macaroons, and labeling the resultant product "Macaroons" without

declaring the presence of glucose on the label, constitute adulteration and misbranding. A bill of exceptions has been filed by the defendant.

This case is at variance with the case of *United States v. Heide* (N. J. 1335), which was tried by jury in the Circuit Court for the Southern District of New York November 3, 1911. In the Heide case the defendant was charged with violating the food and drugs act by the shipment in interstate commerce of an article labeled "Eagle Brand Almond Paste for Macaroons. Flavored with Apricot Kernels * * *," which was alleged to be adulterated in that glucose had been mixed and packed with said article so as to reduce, lower, and injuriously affect its quality and strength, and had been substituted in part for the article. The jury returned a verdict of not guilty.

LEGAL WORK FOR THE FOREST SERVICE.

OPINIONS.

The office has rendered 861 written opinions to the Forester, district foresters, district fiscal agents, and other administrative officers of the department upon questions arising in the administration of the national forests. Many of the questions propounded to the office involved patient and laborious research and issues of fundamental and vital importance in the administration of the forests. Aside from these written opinions the Solicitor and his district assistants have daily advised the Forester and his assistants orally in reference to questions arising in the administration of the national forests.

CONTRACTS.

The Solicitor and his assistants have either prepared or examined for sufficiency and proper execution 1,426 contracts, bonds, leases, stipulations, and other papers of a similar character. These contracts include many cooperative agreements with individuals or States for the suppression of forest fires, sales of large bodies of timber, stipulations required for grants of rights of way, and cooperative agreements with States and individuals for investigations in practical and scientific forestry.

CLAIMS.

This office has handled 1,184 cases involving claims to lands within the national forests under the homestead, timber and stone, mineral, lieu selection, and other general and special land laws of the United States. These cases embraced upward of 200,000 acres of land supporting many million feet of valuable merchantable timber. Not all of these cases came on for hearing during the year, but each one required some attention, varying in degree with the progress of the case in the Interior Department. There were 482 claims cases finally adjudicated during the year. Of these, 369 were decided in favor of the Government and 83 in favor of the claimants. In the remaining 30 cases, the lands involved were either eliminated from the forests before adjudication, or patents were issued upon the recommendation of the Forest Service. As a result of the adjudications in favor of

the Government, approximately 73,000 acres of valuable timbered lands are retained in the national forests for the benefit of the general public. Some of the work incident to the litigation in these claims cases is indicated by a statement of the number of briefs filed by the office, the number of hearings attended, and the number of depositions taken. The assistants to the Solicitor in the field attended and participated in 183 hearings, took depositions in 173 cases, and filed in the Interior Department 115 briefs. The Solicitor prepared and filed in the Department of the Interior 44 briefs; perfected 11 appeals from the Commissioner to the Secretary, submitting at the same time exhaustive briefs on the questions in issue; filed 4 motions for rehearing of decisions of the Secretary; and was represented by his assistants in the Washington office in three oral arguments before the Secretary and the Commissioner. In addition to the work here described, the assistants to the Solicitor in the field examined and passed upon the evidence in many cases prior to reports to the Commissioner of the General Land Office recommending adverse proceedings against claims. They also were in frequent conferences with the executive officers of the Forest Service in the field on questions arising out of the claims cases.

The office now has under consideration the present scheme of co-operation between the Department of the Interior and this department with respect to the handling of litigation involving claims to lands in the national forests with a view to determining whether, and if so to what extent, there may be duplication of work. The ultimate purpose is to recommend such change in the procedure as may be necessary to eliminate such duplication. It is expected that a final determination will be reached early in the ensuing fiscal year.

REGULATIONS.

The office critically examined the regulations and instructions proposed by the Forester for the administration of the laws relating to rights of way over the national forests for the development of hydroelectric power and for telephone, telegraph, and transmission lines. In addition to these, 28 regulations or amendments to existing regulations for the administration of the national forests were passed upon. The appendix to the National Forest Manual, containing the general laws, parts of laws, decisions, and opinions relating to the creation and administration of the national forests, was completed and published February 13, 1913.

PROCLAMATIONS.

The office examined and passed upon 19 proposed proclamations for the elimination of lands from the national forests, or additions of lands to the national forests, during the year.

TRESPASS.

The office handled 436 cases involving trespasses upon lands of the United States within national forests. As a result of that portion of these cases in which fines were imposed or judgments rendered and enforced, there was paid into the Treasury of the United States

\$27,764.91. Several jail sentences were imposed in criminal cases, and there are outstanding unsatisfied judgments amounting to \$5,791.38. The following is a more detailed explanation:

GRAZING.—Seventy-six cases were handled by the department without the intervention of the Department of Justice. Of these, 65 were settled upon demand of the Secretary or the district foresters, and resulted in the collection of \$2,345.95; 10 cases are pending settlement, and 1 case was discontinued upon a reinvestigation. Sixty-five cases were reported to the Department of Justice for the institution of civil suits, of which 33 resulted in the collection of \$3,305.33 actual and \$649.12 punitive damages; judgments which have not yet been satisfied were rendered in 9 cases; 21 cases are pending; 1 case was dismissed; and in 1 case a verdict was returned for the defendant. Thirty-one cases were reported to the Department of Justice for criminal proceedings, 10 resulting in convictions and the payment of fines to the amount of \$480; in 1, defendant was acquitted; in 2, the grand juries returned no true bill; 5 were dismissed; and 13 are pending. Proceedings in contempt for violation of injunctions were instituted in 2 cases, in 1 of which the defendant was discharged, and the other is pending. Injunctions were applied for in 8 cases, 1 of which resulted in a decree for the Government, 5 are pending, and 2 were dismissed.

TIMBER.—Seventy-one cases were handled without the intervention of the Department of Justice, of which 51 resulted in payments upon demand of the Secretary or the district foresters of \$8,570.83; 1 case was dismissed upon reinvestigation; in 3 cases the timber illegally cut was seized and is being held for sale; and 16 cases are pending. Forty-eight cases were reported to the Department of Justice for the institution of civil suits. Of these, 13 resulted in the collection of \$7,950.51; in 4, judgments which have not yet been paid were rendered for \$3,571.53; 4 cases were dismissed; and 27 are pending. Five cases were reported to the Department of Justice for criminal proceedings. One indictment was returned; 1 case is awaiting presentation to the grand jury; and 3 cases were dismissed. Injunctions were sought in 3 cases, in 1 of which a temporary injunction was granted, and in another a bond, in lieu of injunction, was filed, and the remaining case is pending. Proceedings in contempt for violation of an injunction were instituted in 1 case and the defendant was discharged.

FIRE.—Thirteen cases were handled by the department without the intervention of the Department of Justice. Five of these resulted in the collection upon demand of the department of \$257.62. Six cases were discontinued and 2 are pending settlement. Thirteen cases were reported to the Department of Justice for the institution of civil suits, of which 4 resulted in the collection of \$3,305; 3 judgments, amounting to \$1,718.61, have not yet been satisfied. Thirty-five cases were reported to the Department of Justice for the institution of criminal proceedings. Seven resulted in convictions and the payment of fines to the amount of \$845; 2 defendants were sentenced to jail for 60 and 90 days, respectively; 2 defendants were acquitted; indictments were returned in 6; no true bills were returned in 4; 1 defendant is under bond awaiting action

of the grand jury; 7 cases are ready for presentation to grand juries; and 6 cases were dismissed. Thirty-three cases were handled in the State courts of California by the district assistant to the Solicitor in cooperation with State authorities. Twenty-four of these resulted in convictions and the imposition of fines to the amount of \$915; in 2 cases defendants were sentenced to jail; 1 defendant was acquitted; 2 cases are awaiting arrest of defendants; and 4 cases were dismissed.

OCCUPANCY.—Thirty-five cases of illegal occupancy of lands of the United States within national forests were either handled exclusively by the department or were reported to the Department of Justice during the year. Among these cases are 12 involving, in effect, the appropriation of lands of the United States in the national forests for hydroelectric power development without permission from the Secretary of Agriculture, which is required by law. Several of these 12 cases were vigorously litigated during the year, but in only 1 case had a final decision been rendered at the close of the year. Several cases of the illegal inclosure of national forest lands were handled, in 1 of which a restraining order was granted by the court. Two of these cases were adjusted with the trespassers and resulted in the removal of the fences and the payment to the United States of \$16.35 in the nature of rent for the time one of the parcels of land had been inclosed. In a case of willful injury to a Government telephone line, the offender was convicted and sentenced to 10 days' imprisonment. Indictments are pending against 2 defendants for the use of national forest land without permit and for destroying signs erected by the Forest Service. Suit is pending to restrain the construction of a telephone line over one of the national forests in Oregon, the company having refused to apply to the department for a permit. Four suits in ejectment to establish the title of the United States were handled during the year, in 1 of which judgment was entered for the United States. One suit is pending and 2 suits were dismissed. Other minor civil and criminal actions to protect the Government's interests in national forests were instituted.

GENERAL LITIGATION.

The office handled 32 cases in the courts of a miscellaneous nature and not referable to any of the classes above referred to. Among these were 4 suits for the cancellation of patents to lands of the United States procured by fraudulent means. In one of the suits a decree was entered canceling the patent. Two suits are pending, and 1 has been dismissed. Three prosecutions for perjury in connection with claims to lands in the national forests resulted in the acquittal of 2 defendants and the dismissal of the other prosecution. Five suits were instituted to quiet title to lands of the United States within national forests, all of which are pending except 1, in which the suit was dismissed upon the relinquishment by the claimant of coal in the land. One suit by the Government to enforce cancellation of reservoir rights of way in the Rio Grande National Forest resulted in the defendant's relinquishment of the land involved to the United States. The suit against the Telluride Power Co. for \$1,552.44, being the estimated damage for the destruction of a Forest

Service ranger station by the bursting of one of the company's reservoirs, is pending on a compromise proposed by the company. The suit instituted by the Government against the Wagon Wheel Gap Improvement Co. of Colorado to restrain the closing of a road in the Colorado National Forest, claimed by the Government to be a public road, has progressed to the point of taking the testimony. Two cases were referred to the Department of Justice for the institution of suits to declare forfeiture of easements in national forests in Colorado. A fine of \$5 was imposed upon a defendant in the State of New Mexico for an assault upon a forest ranger. The suit instituted in 1910 by the Government against the Hydro Electric Co. of California to restrain it from occupying lands in the Mono National Forest, Cal., for hydroelectric power purposes, was concluded during the year by the company's assignee's application for a permit to legalize the occupancy of the forest. The suit of *Fahey v. Ayres, et al.*, instituted in one of the State courts of California, wherein the complainant seeks an injunction against the defendants, who are forest officers, to restrain the collection of grazing fees for the use of lands in the national forest alleged to be swamp and overflowed, title to which is claimed by the State, is pending the filing of defendants' answer. At the request of this department the United States attorney has intervened in this case to protect the interests of the Government. The cross suits between the United States and W. L. La Motte, involving the use of water in Alder Creek on the Okanogan National Forest, Wash., are still pending, but probably will be determined during the ensuing fiscal year.

DECISIONS OF THE COURTS.

Several decisions of more than passing interest were rendered and deserve special mention in this report.

UNITED STATES V. CHICAGO, MILWAUKEE & ST. PAUL RY. CO.

(Unreported.)

This was a suit by the United States in the District Court for the District of Idaho to compel the company specifically to perform an agreement to execute and file with the Secretary of Agriculture stipulations for the protection of the Coeur d'Alene National Forest, through which the company had constructed its line of road without permission of the Secretary of the Interior and the Secretary of Agriculture. The company's contention, vigorously pressed throughout the litigation, was that by actually constructing its road over lands withdrawn for the national forest it had acquired a right of way under the railroad right of way act of March 3, 1875 (18 Stat., 482), as extended to public reservations by the act of March 3, 1899 (30 Stat., 1214), and that it was beyond the power of the Secretary of the Interior to require the company to execute and file stipulations required by the Secretary of Agriculture for the protection of the national forest through which the road extends. The Government's contention was that the lands having been withdrawn by the Secretary of the Interior for the establishment of the national forest

prior to the filing by the company of its articles of incorporation and maps of definite location of its road, the company could acquire no rights independent of the permission of the Secretary of the Interior, and that the company was a trespasser on the forest. Voluminous testimony was taken and exhaustive briefs filed and oral arguments submitted during the year. The opinion of the court was rendered April 1, 1913, in which it was held that the company had no right to construct its road over the lands involved without the approval of the Secretary of the Interior and without complying with the regulation of said Secretary, which required that the company should file with the Secretary of Agriculture stipulations for the protection of the national forest. A decree was accordingly entered requiring the company specifically to perform its agreement of 1907 to file the stipulations mentioned. As incidental to this relief a decree was also subsequently entered adjudging the company indebted to the United States in the sum of \$68,489 for timber taken and destroyed in the construction of the company's road and for damage to the United States resulting from the casting of rock and other débris into the St. Joe River and its tributaries in the national forest.

UNITED STATES V. UTAH POWER & LIGHT CO. (2 CASES).

UNITED STATES V. BEAVER RIVER POWER CO.

(Unreported.)

These cases involved the right of power companies to occupy lands within national forests for the development of hydroelectric energy without permission of the Secretary of Agriculture and were vigorously litigated in the District Court for the District of Utah. Important questions of law were settled upon motions to strike the Government's bills or portions thereof from the files. The court laid down the following propositions of law as controlling in this litigation:

1. That the act of July 26, 1866 (R. S., 2339), has not been repealed expressly or impliedly by any subsequent acts of Congress providing for rights of way over lands of the United States.
2. That "manufacturing" as used in the act of July 26, 1866, includes the generation of hydroelectric power for general commercial use and sale.
3. That the act of 1866 referred to authorizes the acquisition of rights of way for the diversion, storage, and conveyance of water, but not for power houses or other buildings, transmission lines, telephone lines, tramways, etc.
4. That the act of 1866 has no application to lands withdrawn for forestry purposes or included in national forests.

These rulings set at rest, at least in this litigation, and overthrew the contention of the power companies that the act of 1866 authorized them to acquire rights of way in the national forests without compliance with the requirements of the Secretary of Agriculture, made and promulgated under subsequent right of way statutes which expressly applied to Government reservations and national forests. These rulings also deny the right of power companies, which have acquired rights of way over public lands prior to their inclusion in national forests under the limited provisions of the act of 1866, to extend the uses of those rights of way beyond the objects mentioned in that statute.

In the case against the Utah Power & Light Co., involving a right of way in the Cache National Forest, the Government's bill was dismissed under the rulings of the court on the law because the right of way had been acquired under the act of 1866 prior to the establishment of the National Forest and the easement is not being diverted from the purposes mentioned in that act. But there being a grave doubt as to whether or not the act of 1866, when it authorizes the acquisition of rights of way for manufacturing purposes, includes in that term the generation of hydroelectric energy, the department requested the Attorney General to take an appeal to the circuit court of appeals where that question can be finally adjudicated. While this question is not of especial importance in the administration of the national forests, it is of very great importance to the Department of the Interior in its administration of the acts of Congress authorizing the Secretary of the Interior to permit under regulations by him the acquisition and use of rights of way for power purposes on the unreserved public lands. The two cases in which the Utah Power & Light Co. is defendant are pending the taking of testimony.

Similar questions are involved in four other power right of way cases in the District Court of Colorado, but no decision, either interlocutory or final, had been rendered therein at the close of the year.

UNITED STATES V. E. J. COWLISHAW ET AL.

(202 Fed., 317.)

This case was begun at the request of this department on November 24, 1911, for the purpose of quieting the title of the Government to 560 acres of school land in the State of Oregon. These are lands to which the defendants claim title through grants from the State of Oregon, based upon the State's assumption that, being school sections, they passed to the State although unsurveyed at the time they were included in the national forest. On June 24, 1912, the case was argued and submitted to the court upon a stipulation of facts and thereafter exhaustive briefs were filed by the Government and the defendants. On January 13, 1913, Judge Wolverton directed a decree quieting title of the Government, and this decree was entered on March 17 following. The defendants have removed the case by appeal to the circuit court of appeals where it is now pending. By his decision, Judge Wolverton rules that the State of Oregon acquired no title to unsurveyed sections 16 and 36 which would deprive the President of the power to set these sections aside with other lands of the United States as national forest reservations to be administered in all respects as other national forest lands.

UNITED STATES V. HENRYLYN IRRIGATION CO.

(205 Fed., 970.)

The Government brought suit in the District Court for the District of Colorado for an injunction to restrain the defendant from constructing certain canals and tunnels over lands of the United States in the Arapaho and Pike National Forests, Colo., for an irrigation project without permission of the Secretary of the Interior. The defendant demurred to the Government's bill on general grounds

of want of equity and specifically upon the ground that the approval of the Secretary of the Interior is not necessary to the acquisition of a right of way for irrigation purposes over a national forest under the act of March 3, 1891. The company had applied to the Secretary of the Interior for the approval of its maps, but such approval had been withheld by the Secretary pending certain investigations which he was having made. Nevertheless the defendant commenced and at the time of the filing of the bill was continuing the construction of its canals and tunnels. In overruling the demurrer the court held that a right of way for an irrigation project can not be acquired over a national forest without the approval of the proper executive officers of the Government. Other questions of importance, principally in connection with this case, were decided, but are unnecessary to be mentioned in this report.

ACQUISITION OF LANDS FOR THE PROTECTION OF NAVIGABLE STREAMS.

The so-called Weeks law (36 Stat., 961), approved March 1, 1911, provides for cooperation between the States and the Federal Government in the protection and conservation of forests and forest lands, and the acquisition by the United States of lands with a view to reforesting the watersheds of navigable rivers and streams. It creates a National Forest Reservation Commission and appropriates funds for the acquisition by the Secretary of Agriculture of lands necessary for the accomplishment of the purposes of the law.

Section 9 of the law, as originally enacted, prohibited the acquisition of land encumbered by easements, rights of way, leases, or reservations other than timber and mineral reservations. This provision excluded from purchase large areas of desirable land. To meet this difficulty, under instructions of the Secretary and at the request of the members of the commission, this office prepared an amendment to the section. The amendment, passed by Congress and approved March 4, 1913 (37 Stat., 855), is as follows:

That section nine of the act of March first, nineteen hundred and eleven (Thirty-sixth Statutes, page nine hundred and sixty-one), entitled "An act to enable any State to cooperate with any other State or States, or with the United States, for the protection of the watersheds of navigable streams, and to appoint a commission for the acquisition of lands for the purposes of conserving the navigability of navigable rivers," be amended to read as follows:

"That such acquisition by the United States shall in no case be defeated because of located or defined rights of way, easements, and reservations, which, from their nature will, in the opinion of the National Forest Reservation Commission and the Secretary of Agriculture, in no manner interfere with the use of the lands so encumbered, for the purposes of the act: *Provided*, That such rights of way, easements, and reservations retained by the owner from whom the United States receives title, shall be subject to the rules and regulations prescribed by the Secretary of Agriculture for their occupation, use, operation, protection, and administration, and that such rules and regulations shall be expressed in and made part of the written instrument conveying title to the lands to the United States; and the use, occupation, and operation of such rights of way, easements, and reservations shall be under, subject to, and in obedience with the rules and regulations so expressed."

Under the changed conditions of the law resulting from this amendment many tracts of desirable land, which heretofore could not be considered, are now open to acquisition by the department.

The preliminary legal work incidental to the acquisition of lands under this law was commenced during the fiscal year 1912, and is referred to in the report of this office for that year.

Up to June 30, 1913, the reservation commission authorized the purchase of approximately 713,000 acres of land—287,000 prior to June 30, 1912, and 426,000 between June 30, 1912, and June 30, 1913.

This office has prepared and approved the execution of agreements of purchase between the department and the owners of these lands. The purpose of the agreements is to prevent the sale to third parties of lands approved by the commission, pending survey, examination of title, approval of title by the Department of Justice, and vesting of title in the United States. Prior to the commencement of the present fiscal year no title to any of the land, which the commission had authorized to be purchased, was vested in the United States.

During the present fiscal year this office has been engaged on legal work affecting the entire area of 713,000 acres. The land lies in the seven States of New Hampshire, Virginia, West Virginia, Tennessee, North Carolina, South Carolina, and Georgia. Throughout the year the titles to these lands have been in process of examination by six record examiners under the supervision of this office. These record examiners were appointed from the civil service eligible list and are members of the bars of the several States in which they were designated to perform work. The number of examiners employed during the year has been adequate to keep the title work abreast of the field examinations and survey operations. The field and survey forces have been materially increased. If the title work is to be kept up to date, the force of record examiners must be proportionately increased. It is estimated that at least six additional examiners will be required during the next fiscal year.

As the work of examining titles advances it becomes more apparent that but a small portion of the lands to be acquired can be procured by direct purchase. This situation is not the result of antagonistic feeling toward the project on the part either of the land owners or of the people generally. It arises from the fact that a large proportion of the lands which are desired have heretofore been considered of little value and that the owners have given little care or attention to perfecting their record titles. Many boundary lines have never been run. Instruments affecting much of the lands have been loosely drawn or improperly executed or not placed on record. Not infrequently estates of which the lands form a part have never been administered.

Under these conditions it will be expedient and less expensive in many cases to resort to condemnation of the lands rather than to attempt to cure the defects in the titles.

During the year titles have been approved and become vested in the United States to approximately 103,000 acres of land, and the Department of Justice has been requested to institute condemnation proceedings against approximately 107,000 acres.

THE TWENTY- EIGHT HOUR LAW.

The enforcement of the 28-hour law (act of June 29, 1906, 34 Stat., 607), proceeded vigorously and effectively. The department reported to the Attorney General 1,037 instances of apparent viola-

tions of the statute. This is 406 more cases than were reported in the fiscal year 1912. Nine hundred and sixty-seven cases were pending at the end of the fiscal year 1912 and 672 at the end of the present year. Penalties were recovered in 1,251 cases. In one case sentence was suspended upon payment of costs, 72 cases were dismissed, and 8 cases were determined adversely to the Government. In the preceding fiscal year penalties were assessed in 357 cases, 98 cases were dismissed, and 16 cases were determined adversely to the Government. In 1912 penalties aggregating \$28,400 were recovered; in 1913 penalties aggregating \$61,695 were recovered.

The enforcement of the 28-hour law has resulted in the more humane treatment of cattle in the course of transportation. Attention has been called in previous reports of this office to the need for a law regulating the minimum speed of trains carrying live stock. It is believed that such a measure would be both beneficial to stock in transit and in the interest of shippers.

In connection with the disposition during the year of some of the most important cases arising under this statute, several conferences were held by this office with representatives of carriers involved, who agreed strictly to observe the law in future. As an outcome of these conferences and of conferences with the Department of Justice, a circular, prepared by the Bureau of Animal Industry in conjunction with this office, was issued May 31, 1913, setting forth the requirements of the Department of Agriculture as to The Feeding, Watering, and Resting of Live Stock in the Course of Interstate Transportation.

DECISIONS OF THE COURTS.

During the year the following important decisions of the Federal courts were handed down in cases arising under the 28-hour law:

NEW YORK CENTRAL & HUDSON RIVER R. R. CO. V. UNITED STATES.

(Circular No. 73, Office of the Solicitor.)

The court of appeals for the second circuit held that connecting carriers are bound to make reasonable inquiry as to the length of time live stock have been previously confined in cars without feed, rest, and water. The court further held that, *prima facie*, 3 hours and 35 minutes is too long a time to consume in transporting a shipment of live stock 7 miles and that, to avoid a charge of willful violation, the defendant carrier should have offered proof to excuse its lack of diligence.

ERIE RAILROAD CO. V. UNITED STATES.

(200 Fed., 406; Circular No. 67, Office of the Solicitor.)

This case involved the confinement of a shipment of cattle for a period in excess of 36 hours in cars which did not afford sufficient space and opportunity for the animals to rest. The circuit court of appeals for the second circuit affirmed the decision of the lower court, holding that all the animals must have sufficient space in which to lie down at the same time.

UNITED STATES V. LEHIGH VALLEY R. R. CO.

(Circulars Nos. 65 and 75, Office of the Solicitor.)

The District Court for the District of New Jersey held that the failure to feed and water sheep which had been unloaded within, and were not confined in cars beyond, the statutory period did not constitute a violation of the statute. On appeal, without passing upon the correctness of the ruling of the district court, the court of appeals for the second circuit affirmed the judgment below on the ground that it had not been shown that the carrier's failure was knowing and willful.

ACTS REGULATING THE INTERSTATE MOVEMENT OF LIVE STOCK FROM QUARANTINED DISTRICTS AND PROHIBITING THE INTERSTATE MOVEMENT OF DISEASED LIVE STOCK.

During the year 80 apparent violations of the act of March 3, 1905 (33 Stat., 1264), and 12 apparent violations of the act of May 29, 1884 (23 Stat., 31), were examined and reported to the Attorney General, a decrease of 44 under the act of 1905, and an increase of 1 under the act of 1884, over the number reported during the preceding fiscal year.

Cases charging 89 violations of the act of 1905 and 4 violations of the act of 1884 were determined favorably to the Government, for the most part upon pleas of guilty. Fines aggregating \$9,550 as a result of these convictions under the act of 1905 and \$725 in those under the act of 1884 were assessed. These sums are exclusive of costs. In one case under the act of 1884, the defendant was sentenced to pay a fine of \$300, and in another, to pay a fine of \$250. In one case, sentence was suspended upon payment of costs. In 3 cases under the act of 1905 and 1 case under the act of 1884 grand juries failed to return indictments.

At the close of the fiscal year there were pending in the courts 66 cases involving violations of the act of 1905 and 8 cases involving violations of the act of 1884.

Proceedings were dismissed during the year in 2 cases under the act of 1905 and in 5 cases under the act of 1884.

Two cases were reported to the Attorney General during the year under the act of February 2, 1903 (32 Stat., 791). In one of the cases the defendant, upon a plea of guilty, was fined \$100 and the other case was pending in court at the close of the fiscal year.

By the act of March 4, 1913 (37 Stat., 828), the provisions of the act of March 3, 1905, were extended to connecting carriers. This amendment was made to meet the decision of the Supreme Court of the United States in *Baltimore & Ohio Southwestern Railroad Co. v. United States* (222 U. S., 8), in which it was held that the act of March 3, 1905, does not apply to a carrier which receives a shipment of live stock outside of the quarantined area, even though the same originated in the quarantined area. It is believed that the amendment will render the enforcement of the act much more effective than it has been in the past.

Several orders of the Secretary of Agriculture establishing or changing quarantines under section 1 of the act of 1905 were examined as to their legal form and sufficiency.

THE MEAT-INSPECTION LAW.

There were reported to the Attorney General 81 apparent violations of the meat-inspection law of June 30, 1906 (34 Stat., 674). During the fiscal year 1912 85 such violations were similarly reported. Of the 81 cases reported during the year, together with those coming over from previous years, 64 resulted in convictions, 13 were dismissed, in 12 cases the grand juries failed to return indictments, and in one case a verdict was rendered for the defendant. In two of the cases in which convictions were secured sentence was suspended upon payment of costs. In 7 cases sentences of imprisonment were imposed, one amounting to 30 days, another to 5 days, and a third to 3 days; in four cases the offenders were fined and received sentences of imprisonment of 60 days each. However, the last four sentences mentioned were suspended upon payment of the fines imposed. Fines of \$500 in two cases, \$250 in one, and \$200 in another were imposed. At the close of the year 62 cases were pending. The total fines assessed during the year amounted to \$3,315, as compared with \$4,746.75 in fines assessed in 1912.

Quite as much time of this office is taken up in giving formal and informal advice to the officials of the Bureau of Animal Industry on questions of law arising in the course of the performance of their duties as is given to the consideration of cases reported to the Department of Justice.

ST. LOUIS INDEPENDENT PACKING CO. V. DAVID F. HOUSTON ET AL.

(204 Fed., 120.)

One of the most important cases which has ever arisen under the meat-inspection law was commenced during the fiscal year in the District Court for the Eastern District of Missouri. This was an equity suit for a mandatory injunction to restrain the Secretary of Agriculture, the Chief of the Bureau of Animal Industry, and the inspector in charge at St. Louis, Mo., from refusing to mark as "inspected and passed" sausage manufactured by the complainant company. The basis of the bill of complaint is the contention that the regulation promulgated by the Secretary on February 28, 1913, prohibiting the use of cereal in sausage in excess of 2 per cent and requiring that if cereal be added to the product its presence must be stated on the label, and providing, further, the conditions under which water may be added or used in sausage, are unauthorized and void. On the hearing of an application for an injunction pendente lite, the district court sustained the validity of the regulation, dismissed the bill as to the Secretary of Agriculture and the Chief of the Bureau of Animal Industry for want of jurisdiction, and denied the prayer for temporary injunction. An appeal was taken to the circuit court of appeals for the eighth circuit, where the case has been argued, but as yet no decision has been handed down.

THE LACEY ACT.

During the preceding fiscal year 34 cases involving unlawful shipments of game were reported to the Attorney General. During the present fiscal year 154 cases have been reported to the Attorney General, 73 of which resulted in convictions, almost without excep-

tion on pleas of guilty, in which fines were imposed amounting to \$3,557. In addition, 6 cases which had been reported during the preceding fiscal year were terminated during the present year, resulting in the imposition of fines to the amount of \$510. Four cases were dismissed during the year because of insufficient evidence to maintain the prosecutions and in view of fines imposed in other cases against the same defendants. The remaining cases were pending at the close of the year. It is worthy of note that in 3 of the cases reported during the year, sentences to pay the maximum fine, \$200, were imposed, and in 14 cases fines of \$100 were imposed. In a number of cases the costs which were adjudged against defendants amounted to more than the fines imposed upon them, so that the aggregate amount of money paid by these defendants was probably adequate to restrain them from further violations of the law.

The activities of the Bureau of Biological Survey, upon which the responsibility for procuring the evidence of these violations rests, were directed during the year in the States of North Carolina, Tennessee, Virginia, West Virginia, and Kentucky, with occasional attention to shipments of game in Illinois, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. In Kentucky, Tennessee, North Carolina, and Virginia, the investigations of the bureau developed 118 apparent violations of the law, besides furnishing information which will lead to the submission to the Department of Justice in the following fiscal year of numerous other apparent offenses.

The efforts of the department to suppress the illicit interstate traffic in game killed in the several States are having a marked tendency toward the awakening of activity by the States in the enforcement of their game laws.

No important or far-reaching rulings were made by the courts in the enforcement of this act for the reason that practically every case was concluded without contest by pleas of guilty. One of the two cases prosecuted in Pennsylvania involved the shipment of the plumes of herons, commonly called aigrettes, in a package which was not marked with the name and address of the shipper and the nature of the contents, as required by section 243 of the Penal Code of the United States. The defendant pleaded guilty and was fined \$10. All the other cases involved the shipment of game birds or mammals. To show the extent to which illicit traffic in game has proceeded, it may be well to mention the fact that the records of the department show that during the fiscal year upward of 100,000 quail alone were shipped in violation of law.

THE INSECTICIDE ACT OF 1910.

There was a large increase over the preceding year in the volume of work in this office pertaining to the enforcement of the insecticide act.

The evidence of apparent violations of the act in 290 cases collected by the Insecticide and Fungicide Board was submitted to and examined by this office for the purpose of determining whether hearings should be held under section 4 of the act and the board advised in reference thereto.

In 137 cases, in some of which hearings were held and in some of which there were no hearings by the board, this office examined the evidence and determined that legal proceedings ought not to be instituted. In some of the cases the evidence was insufficient; in others, the violations were technical only, without wrongful intent; in others, the manufacturers had already been convicted of subsequent offenses and had thereafter conformed to the law; in others, more could be accomplished by accepting the offers of manufacturers to correct their alleged misconduct and to comply with the requirements of the board than by litigation. In most of such cases there was considerable correspondence with the persons complained of, all of which was conducted by this office. In general, the department has met with ready acquiescence in its views. The results obtained have fully justified the practice adopted.

In 344 cases examined the evidence showed no offense or that the offense was too trivial to warrant action or that for other reasons the Government could not succeed in legal proceedings. On the advice of this office all such cases were placed in abeyance after correspondence with the persons complained of.

In 108 cases in which, after hearings had been held by the board it appeared that there had been violations of law, the facts were certified to the Department of Justice for action. In 100, criminal proceedings, and in 8, seizures were recommended. All such cases were prepared by this office on the evidence and the law before transmission to the Attorney General. This office has frequently rendered assistance to United States attorneys in pending cases by the preparation of briefs and memoranda on legal questions.

During the year 60 cases which had been reported by this office to the Department of Justice during this year or preceding years were terminated. Fifty-two of these cases were criminal and 8 were seizure cases.

Of the criminal cases 44 were disposed of on pleas of guilty, 7 on pleas of nolo contendere, and 1 upon a verdict of not guilty. The last was the only case terminated adversely to the Government. In 12 of the criminal cases sentences were suspended. In the other criminal cases fines aggregating \$1,100 were imposed, classified as follows:

No. of violations.	No. of fines.	Total fines.
3	1	\$200
1	1	100
1	1	75
5	5	250
18	15	375
9	9	90
2	2	10
39	34	1, 100

Costs were generally assessed in cases where convictions were obtained.

Decrees of condemnation and forfeiture were rendered in all seizure cases terminated during the year.

At the end of the year there were informations pending in cases involving 29 alleged criminal violations reported to the Department of Justice. All seizure cases had been disposed of.

A noteworthy case terminated during the year was *United States v. Thirty Dozen Packages of Roach Food*. (Notice of Insecticide Act Judgment, No. 29.) In that case it was for the first time judicially determined that an ingredient of an insecticide is inert within the meaning of the insecticide act, notwithstanding that it serves to attract insects to consume the product.

Twenty-two notices of judgment prepared in this office were published under section 4 of the act.

MISCELLANEOUS CASES.

Eight cases of apparent violations of the general criminal laws of the United States were reported by this office to the Department of Justice. In one, involving falsification of accounts by an employee of the Department of Agriculture, the defendant was convicted and sentence suspended. In another, involving an assault on an employee of the Department of Agriculture, the defendant was convicted and sentenced to pay a fine of \$25 and costs of \$21.86. The other cases were pending at the end of the year, either in the courts or in the Department of Justice.

AGREEMENTS FOR THE SEVERAL BUREAUS, OFFICES, AND DIVISIONS.

BUREAU OF PLANT INDUSTRY.

There were 123 contracts, 39 leases, 58 renewals, 2 notices of termination, and 7 bonds prepared for the Bureau of Plant Industry during the year 1913. This is an increase of 34 contracts, 22 renewals, 1 notice of termination, and 6 bonds over the preceding year.

BUREAU OF ANIMAL INDUSTRY.

There were 22 contracts, 44 leases, 26 renewals, and 8 notices of termination prepared for the Bureau of Animal Industry during the year 1913. This is an increase of 23 leases and 7 notices of termination, and a decrease of 9 contracts and 5 renewals over the preceding year.

WEATHER BUREAU.

There were 79 contracts, 68 leases, 92 renewals, and 10 notices of termination prepared for the Weather Bureau during the year 1913. This is an increase of 65 contracts, 34 leases, and 5 notices of termination, and a decrease of 12 renewals over the preceding year.

OFFICE OF PUBLIC ROADS.

There were 15 contracts and 3 renewals prepared for the Office of Public Roads during the year 1913, an increase of 10 contracts and 2 renewals over the preceding year.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

There were 2 bonds prepared for the Division of Accounts and Disbursements during the year 1913; none during the preceding year.

INSECTICIDE AND FUNGICIDE BOARD.

There were 9 contracts prepared for the Insecticide and Fungicide Board during the year 1913; none during the preceding year.

LIBRARY.

During the year 1913 three contracts were prepared for the Library; none during the preceding year.

BUREAU OF SOILS.

There were 4 contracts prepared for the Bureau of Soils during the year 1913; none during the preceding year.

SUPPLY DIVISION.

There were 2 contracts prepared for the Supply Division during the year 1913; none during the preceding year.

BUREAU OF CHEMISTRY.

There were 2 contracts, 9 leases, and 12 renewals prepared for the Bureau of Chemistry during the year 1913, a decrease of 5 contracts and 2 renewals and an increase of 1 lease over the preceding year.

OFFICE OF EXPERIMENT STATIONS.

There were 2 contracts, 18 leases, 8 renewals, and 3 notices of termination prepared for the Office of Experiment Stations during the year 1913. This is an increase of 1 notice of termination and a decrease of 5 contracts, 8 leases, and 1 renewal over the preceding year.

BUREAU OF ENTOMOLOGY.

There were 6 contracts, 15 leases, 11 renewals, 6 notices of termination, and 1 bond prepared during the year 1913. This is a decrease of 1 contract, 13 leases, and 12 renewals, and an increase of 5 notices of termination over the preceding year.

OFFICE OF CHIEF CLERK.

During the year 1913 there were 5 contracts, 22 leases, 14 renewals, and 12 notices of termination prepared for the Office of Chief Clerk. In the preceding year only 4 contracts and 1 bond were prepared for this office.

BUREAU OF BIOLOGICAL SURVEY.

During the year 1913 one contract was prepared for the Bureau of Biological Survey; none during the preceding year.

For the bureaus, divisions, and offices there were prepared a total of 488 contracts and leases during the fiscal year 1913, as against 324 in the fiscal year 1912. All of these contracts and leases were subsequently examined and passed upon by this office as to the legal sufficiency of their execution.

PATENTS FOR DEDICATION TO THE PUBLIC.

During the year 9 applications for letters patent were filed, as compared to 19 for the preceding year.

Of the cases pending 13 patents were allowed and 4 disallowed, while during the preceding year 10 such patents were allowed and none disallowed.

The applications prosecuted for patent cover a wide technical field, including humidistat regulators, bulb seecoping machine, apparatus for recording duration of rainfall, hypsometers, and various other subject matters.

PUBLICATIONS OF THE OFFICE.

The work of the preparation of a compilation entitled "Laws Applicable to the United States Department of Agriculture," revised to embrace enactments down to and including the second session of the Sixty-second Congress, ending August 27, 1912, was completed and the work published during the year. A supplement to this work, embracing enactments of the third session of the Sixty-second Congress, ending March 4, 1913, was also compiled.

A compilation of decisions under the food and drugs act, with digest and notes, was in the course of preparation at the close of the year.

There was issued during the year a compilation of general laws, decisions, and opinions applicable to the creation, administration, and protection of the national forests.

Under authority of section 4 of the food and drugs act and section 4 of the insecticide act of 1910 there were published 889 notices of judgment.

During the year 11 office circulars were issued, 4 containing decisions of the courts under the food and drugs act, 4 decisions under the 28-hour law, and 1 decision each under the national forest administrative act, the plant quarantine act, and the meat inspection law.

CLAIMS FOR BALANCES DUE ESTATES OF DECEASED EMPLOYEES.

During the fiscal year 23 claims for balances due the estates of employees of the department who died intestate were examined, the necessary papers prepared for the payment of same, and advice furnished administrative officers of the department relative thereto.

REPORT OF THE APPOINTMENT CLERK.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE APPOINTMENT CLERK,
Washington, D. C., August 27, 1913.

SIR: I have the honor to submit herewith the statistical information which is compiled annually in the office of the appointment clerk, as shown by the records on July 1, 1913.

Very respectfully,

R. W. ROBERTS,
Appointment Clerk.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

From a comparison with similar data obtained on July 1, 1912, it will be seen that a net increase in the personnel of 620 occurred during the annual period ending July 1, 1913, the total number of employees in the department on July 1, 1913, being 14,478, as compared with 13,858 on July 1, 1912.

The total number of changes of all kinds effected during the fiscal year 1913 amounting to 44,535, as compared with the next preceding annual period, shows a total decrease of 397; while the decrease in number of temporary field employments was approximately 3,000, an increase of 1,759 changes has, however, been made in the other classes of employees during the former period.

STATISTICAL INFORMATION.

Changes in the United States Department of Agriculture during the fiscal year 1912-13.

[From monthly reports to the Civil Service Commission.]

CLASSIFIED SERVICE.

Appointments for a probationary period of 6 months.....	1, 134
Reinstatements in the service.....	153
Transfers within the department.....	499
Transfers from other departments of the Government to this department.....	83
Promotions in salary.....	2, 699
Reductions in salary.....	113
Temporary or emergency appointments for periods of 6 months or less.....	1, 124
Declination of and failures to accept appointment.....	71
Resignations.....	885
Appointments terminated.....	227
Removals from the service on account of misconduct, etc.....	38
Deaths.....	52
Temporary appointees whose services were terminated.....	668

CLASSIFIED SERVICE—POSITIONS EXCEPTED FROM EXAMINATION.

Appointments for temporary periods.....	2, 919
Promotions in salary.....	145
Reductions in salary.....	115
Transfers made within the department.....	25
Separations from the service (through removal, resignation, or death).....	424
Appointments terminated.....	1, 925

UNCLASSIFIED SERVICE.

Appointments in the District of Columbia.....	30
Promotions in salary in the District of Columbia.....	50
Reductions in salary in the District of Columbia.....	4
Separations from the service in the District of Columbia.....	27
Appointments outside of Washington, D. C.....	339
Promotions in salary outside of Washington, D. C.....	31
Reductions in salary outside of Washington, D. C.....	6
Separations from the service outside of Washington, D. C.....	228
Temporary employments for periods of 6 months or less in the forests and fields and on the stations in the various States outside of Washington, D. C.....	29, 819
Temporary or emergency appointments in the District of Columbia.....	184
Separations of temporary or emergency appointees in the District of Columbia.....	164
Miscellaneous changes (not covered by any of the above classes).....	354
Total number of changes reported.....	44, 535

Males and females employed in the various bureaus, divisions, and offices of the United States Department of Agriculture, in and out of Washington, D. C., on July 1, 1913.

Bureau, division, office, etc.	In Washington.			Out of Washington.			Total.
	Males.	Females.	Total.	Males.	Females.	Total.	
Office of the Secretary.....	242	28	270	20	20	290	290
Weather Bureau.....	186	16	202	1,677	223	1,900	2,102
Bureau of Animal Industry.....	230	58	288	3,082	10	3,092	3,380
Bureau of Plant Industry.....	555	220	775	1,498	253	1,751	2,526
Forest Service.....	132	125	257	3,690	223	3,913	4,170
Bureau of Chemistry.....	206	53	259	243	33	276	535
Bureau of Soils.....	137	13	150	43	43	193	193
Bureau of Entomology.....	59	35	94	159	3	162	256
Bureau of Biological Survey.....	41	8	49	36	36	85	85
Division of Publications.....	76	94	170			170	170
Bureau of Statistics.....	50	51	101	67	1	68	169
Office of Experiment Stations.....	67	45	112	107	12	119	231
Library.....	7	21	28			28	28
Office of Public Roads.....	52	14	66	126	5	131	197
Division of Accounts and Disbursements.....	51	11	62	6	6	68	68
Insecticide Board.....	30	2	32	7	7	39	39
Federal Horticultural Board.....	6	3	9	29	1	30	39
Total.....	2,127	797	2,924	10,790	764	11,554	14,478

Officers and employees of the department on statutory rolls and those paid from lump-sum funds, July 1, 1913.

Bureau, division, office, etc.	On statutory rolls.	On lump-sum funds.	Total.
Office of the Secretary.....	260	30	290
Weather Bureau.....	375	1,727	2,102
Bureau of Animal Industry.....	371	3,009	3,380
Bureau of Plant Industry.....	460	2,066	2,526
Forest Service.....	1,861	2,309	4,170
Bureau of Chemistry.....	243	292	535
Bureau of Soils.....	43	150	193
Bureau of Entomology.....	51	205	256
Bureau of Biological Survey.....	24	61	85
Division of Accounts and Disbursements.....	68	68	68
Division of Publications.....	170	170	170
Bureau of Statistics.....	97	72	169
Office of Experiment Stations.....	61	170	231
Library.....	27	1	28
Office of Public Roads.....	42	155	197
Insecticide Board.....		39	39
Federal Horticultural Board.....		39	39
Total.....	4,153	10,325	14,478

Officers and employees in the various bureaus, divisions, and offices, and their classification.

Bureau, division, office, etc.	Competitive.	Excepted.				Total.
		Experts and agents.	Collaborators, student assistants, etc.	Forest guards.	Unclassified.	
Office of the Secretary.....	228	5			57	1 290
Weather Bureau.....	² 813		³ 1,271		18	2,102
Bureau of Animal Industry.....	3,058	129	7		186	3,380
Bureau of Plant Industry.....	869	603	797		257	2,526
Forest Service.....	2,637	10	24	1,452	47	4,170
Bureau of Chemistry.....	452	25	33		25	535
Bureau of Soils.....	145	3	39		6	193
Bureau of Entomology.....	180	52	14		10	256
Bureau of Biological Survey.....	49	9	25		2	85
Division of Publications.....	163				7	170
Bureau of Statistics.....	116	48			5	169
Office of Experiment Stations.....	175	22	23		11	231
Library.....	27				1	28
Office of Public Roads.....	115		73		9	197
Division of Accounts and Disbursements.....	68					68
Insecticide Board.....	37				2	39
Federal Horticultural Board.....	9		30			39
Total.....	9,141	906	• 2,336	1,452	643	14,478

¹ Including Secretary and Assistant Secretary (presidential) and 2 private secretaries.

² Including Chief of Weather Bureau (presidential).

³ Including special river observers, special cotton-region observers, special meteorological observers, etc.

REPORT OF THE INSECTICIDE AND FUNGICIDE BOARD.

UNITED STATES DEPARTMENT OF AGRICULTURE,
INSECTICIDE AND FUNGICIDE BOARD,
Washington, D. C., September 3, 1913.

SIR: I have the honor to submit herewith a concise report on the work of the Insecticide and Fungicide Board for the fiscal year ending June 30, 1913.

Very respectfully,

J. K. HAYWOOD,
Chairman of Board.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

In the enforcement of the insecticide act, the department has to do with two classes of products: (1) Those which enter interstate commerce or are sold or manufactured within the District of Columbia or the Territories, and (2) those offered for import into the United States at its various ports of entry.

The board has conducted a large number of hearings in cases of alleged violations of the law and carried on an extensive correspondence with manufacturers and dealers relating to the application of the law to various insecticides—Paris greens, lead arsenates, and fungicides—and the complex questions arising in the interpretation of the law. Through such correspondence many faulty labels have been adjusted without resort to the courts. Certain members of the board and scientific employees of the board have also visited various manufacturing establishments for the purpose of investigating methods of manufacture from a scientific standpoint. Not only have such inspections resulted in obtaining information of material service to the board in the enforcement of the law, but the board has been placed in better position to give manufacturers scientific information relative to correcting faulty methods of manufacture, faulty methods of analysis, and faulty methods of test, which information has been of signal service to the manufacturers in aiding them to place better insecticides and fungicides on the market with more correct labels.

INTERSTATE SAMPLES.

During the fiscal year ending June 30, 1913, 997 samples from interstate shipments of insecticides and fungicides were collected. Disposition has been made of 504 of the cases based on these samples, 396 having been placed in permanent abeyance and 108 reported for prosecution. Twenty-four of the prosecution cases have been consid-

ered by the courts, with results favorable to the Government's contention in all but one case. There have been published to date 23 notices of court judgments. The demand for these notices is large, and it is apparent that many manufacturers and dealers are keeping in close touch with the enforcement of the law. Of the remaining cases based on domestic samples collected, 52 are before the board and office of the solicitor for consideration, 107 are held pending receipt of further information or the outcome of prosecutions based on the same product, 26 are awaiting reports of hearing, while 308 samples are undergoing analysis and test.

IMPORT SAMPLES.

During the year 82 official and unofficial import samples of insecticides and fungicides were collected by various port laboratories of the Bureau of Chemistry for examination and test by the board, 23 official samples being found to be adulterated or misbranded or both, and it was recommended that entry into this country be entirely forbidden or that the consignment be released when correctly labeled. The remaining samples were unofficial, 35 of which were found to be adulterated or misbranded or both, and it was recommended that future shipments be detained, while 24 were neither adulterated nor misbranded.

SPECIAL INVESTIGATIONS.

Various scientific investigations have been made by the board in co-operation with the various bureaus of the department to obtain basic facts to aid in the enforcement of the law.

Not only have various commercial insecticides and fungicides been tested relative to their action on the insects and fungi mentioned on the labels, but the individual substances entering into such insecticides and fungicides have been tested to determine whether or not they are active or inert against certain classes of insects or fungi for which they are recommended. Much of this work is pioneer in character and requires long, painstaking, and repeated experiments.

Field experiments to determine the injury to vegetation by certain individual insecticides and fungicides and certain classes of these substances have been carried on; and as a result of such experiments, coupled with previous work of the department, manufacturers have been warned that they risk violation of that section of the act reading—

That for the purpose of this act an article shall be deemed to be adulterated * * *. In the case of insecticides or fungicides other than Paris green or lead arsenate * * *. If it is intended for use on vegetation and shall contain any substance or substances which, although preventing, destroying, repelling, or mitigating insects, shall be injurious to such vegetation when used—

in case they recommend the employment of lime-sulphur solution as a summer spray or Bordeaux mixture on foliage susceptible to injury by these compounds, such as peach or Japanese plum.

Further field and laboratory work on the effect of Paris green containing varying amounts of arsenic in water-soluble forms on foliage and the development of a laboratory method by which this constituent can be determined have been continued. While certain inter-

esting facts have been brought to light, the results are not sufficiently conclusive for publication, and the work will probably have to be continued another year.

An investigation of methods for determining the amount of stems and sand in pyrethrum powders and the establishment of allowable limits for these two adulterants of pyrethrum powder have been started and will be continued during the coming year. Also an investigation of methods of determining the alkaloids and dirt in powdered white hellebore and ascertaining a standard for powdered white hellebore has been started.

A study has been started of the preparation, under factory conditions, of otho and pyro lead arsenates, for the purpose of determining proper labeling of same and for the purpose of determining under what conditions these two classes of compounds may be formed and may exist. Chemical methods for determining the constituents in various complex insecticidal and fungicidal mixtures have been developed.

An investigation of the poisonous properties of various insecticidal and fungicidal substances has been inaugurated and will be continued during the coming year. Special attention has been given to the creosote and phenolic dips and disinfectants which are claimed to be poisonous by the department and nonpoisonous by the manufacturer.

REPORT OF THE FEDERAL HORTICULTURAL BOARD.

U. S. DEPARTMENT OF AGRICULTURE,
FEDERAL HORTICULTURAL BOARD,
Washington, D. C., August 30, 1913.

SIR: I submit herewith an executive report covering the administration of the plant quarantine act for the fiscal year ended June 30, 1913.

Respectfully,

C. L. MARLATT,
Chairman of Board.

Hon. DAVID F. HOUSTON,
Secretary of Agriculture.

FEDERAL PLANT QUARANTINE ACT.

The Federal plant quarantine act of August 20, 1912, was immediately effective as to certain quarantines, but not effective as to control of nursery stock importations or other features covered until October 1, 1912. This act was amended March 4, 1913, by adding a proviso to section 7 permitting importation by the Department of Agriculture of plants or plant products under quarantine.

The purpose of this act is to enable the Secretary of Agriculture to regulate the importation of nursery stock and other plants and plant products, and to enable him to establish and maintain quarantine districts for plant diseases and insect pests, and to quarantine against diseased plants or plant products of foreign countries.

THE FEDERAL HORTICULTURAL BOARD.

The act provides (sec. 12) that for the purpose of carrying out its provisions there shall be appointed by the Secretary of Agriculture from existing bureaus and offices in the Department of Agriculture, including the Bureau of Entomology, the Bureau of Plant Industry, and the Forest Service, a Federal Horticultural Board consisting of five members, of whom not more than two shall be appointed from any one bureau or office, and who shall serve without additional compensation. Immediately after the passage of the act the Secretary of Agriculture appointed the following members to constitute this board:

C. L. Marlatt, chairman, Bureau of Entomology; W. A. Orton, vice chairman, Bureau of Plant Industry; George B. Sudworth, Forest Service; A. F. Burgess, Bureau of Entomology; Peter Bisset, Bureau of Plant Industry.

Owing to the needs of departmental work it has been necessary to change this board, and it is at present constituted as follows:

C. L. Marlatt, chairman, Bureau of Entomology; W. A. Orton, vice chairman, Bureau of Plant Industry; George B. Sudworth, Forest Service; W. D. Hunter, Bureau of Entomology; A. V. Stubenrauch, Bureau of Plant Industry.

FEDERAL INSPECTION SERVICE.

The supervision of the general Federal inspection service required by the act, namely, that relating to inspection of nursery stock from countries without an official system of inspection, and the inspection necessitated by domestic and foreign quarantines promulgated under the act, is assigned to two principal inspectors, Mr. E. R. Sasser, transferred from the Bureau of Entomology, and Mr. Perley Spaulding, transferred from the Bureau of Plant Industry. In addition, these men act in an advisory capacity in relation to the examination by State inspectors of nursery stock imported from countries maintaining inspection service.

The requirements of the act in relation to uncertified imported nursery stock may call for inspection at almost any port of entry in the United States, and, furthermore, the special enforcement of foreign and insular domestic quarantines may require an expert inspection service at ports of entry. This is now true in the case of the Hawaiian and Mexican quarantines. Such domestic quarantines as the moth quarantine in New England call for a considerable force of inspectors to supervise the movement of the articles covered by the quarantine. To meet these several needs, the State inspection service has been largely utilized, these State officers having been appointed collaborators of the Department of Agriculture at merely nominal salaries. Some 72 such appointments have been made at salaries ranging from \$1 a year to \$25 a month, depending upon the amount of work which the individual is asked to perform.

In addition to the above, some work in foreign countries, partly of the nature of inspection and partly investigative, has been found necessary, notably in connection with the establishment of the Mexican quarantine and as a means of determining the need of quarantine against certain fruits from the Mediterranean countries. Two such agents have been temporarily employed.

COOPERATION WITH OTHER DEPARTMENTS.

The heartiest cooperation in carrying out the provisions of the plant quarantine act has been rendered by the State, Treasury, and Post Office Departments. In the case of the Treasury Department particularly this has involved a very considerable addition to the duties of customs officers, and the assistance of these officials has been of the greatest value. Through the State Department cooperation of foreign Governments has been effected.

In connection with the cooperation by the Post Office Department, perhaps the most useful single feature has been the prohibition of the importation of nursery stock, as defined in the act, in the mails from foreign countries on and after July 1, 1913, except as to plants addressed to the United States Department of Agriculture, Wash-

ington, D. C. The authority for this action is not found in the plant quarantine act, but is within the powers of the Post Office Department, and supplements, in a very important manner, the plant quarantine act in its relation to the importation of nursery stock. The impracticability of examination, either by State or by Federal officials, of small and practically valueless mail shipments of plants will be apparent to anyone.

REVIEW OF THE WORK OF THE YEAR.

The work of the first year of the enforcement of the Federal plant quarantine act may be conveniently considered under the following heads: (1) Nursery stock importations, (2) foreign plant quarantines, (3) domestic plant quarantines, and (4) investigation of foreign insect or disease enemies of plants as a basis for possible quarantine action.

NURSERY STOCK IMPORTATIONS.

Nursery stock offered for entry into the United States falls into two classes, namely:

(1) That coming from countries having an official inspection and certification system, and

(2) From countries which have no system of inspection or certification.

Nursery stock from the first class of countries arrives with some assurance of freedom, or at least the responsibility for its condition fixed on some known foreign official.

Nursery stock from the second class of countries arrives with no information as to its probable freedom from infestation by insects or diseases.

Commercial importations are permitted only from countries belonging to the first category, and from countries belonging to the second category importations are limited by regulation and permitted only for experimental or scientific purposes.

The following countries have provided for inspection and certification of export plants and plant products in conformity with the regulations under the plant quarantine act:¹ Holland, Belgium, France, Germany, Denmark, England, Scotland, Ireland, Japan, Canada, Guatemala, Trinidad, Cuba, Luxemburg, and Bermuda, and these include most of the countries, which have hitherto maintained any considerable commercial trade in nursery stock with the United States. Any other country may obtain the benefits of commercial exportation by providing for the proper inspection and certification of exported stock. The conditions governing importations from countries of these two classes are fully detailed in Circular No. 44, Office of the Secretary, giving the rules and regulations for carrying out the plant quarantine act.

There was necessarily some misunderstanding and some confusion incident to the installation of Federal control of the importation of

¹ Attention should be called in this connection to Plant Quarantine Decision No. 4, issued July 17, 1913, amending Regulation 7 as follows:

"Permits may be canceled and further permits refused for the importation of nursery stock from any given country whenever such stock, in the judgment of the Federal Horticultural Board, is found to be so infested as to plainly indicate that the foreign inspection is merely perfunctory, and such countries shall thereafter be classed as countries which do not maintain nursery stock inspection until satisfactory evidence is presented to show that the regulations of the board have been complied with."

nursery stock from foreign countries. In the main, the importers of nursery stock have endeavored to comply with the law and meet all of its conditions, and even this first year this feature of the work has been very successful and a very large protection has been secured without putting any serious restrictions or heavy burdens on the nursery trade.

The Federal act has also very greatly stimulated those foreign countries which have considerable commercial trade in plants with the United States to do better work of inspection and to provide suitable legislation and officers to meet the requirements of the act. The result of this is already shown in the better quality of the imported nursery stock and its more general freedom from infestation.

In general explanation of the Federal powers in relation to the importation of nursery stock it may be said that these powers relate (1) to the issuance of permits for the importation of nursery stock, (2) the provision for foreign inspection and certification as a condition of entry, and (3) the distribution to the several State inspectors of exact information in regard to the origin, arrival, and destination of the imported stock.

To the several States is left the entire responsibility for the inspection at destination of commercial importations of nursery stock, and, if this inspection is not done by State inspectors, there is nothing in the Federal law to make good this neglect.

INSPECTION OF IMPORTED NURSERY STOCK.

The duty of this department in relation to these commercial importations after entry is to transmit to the proper State inspectors the reports of these importations received from the importers through the different customs officers. These notifications have been duly distributed, and practically all the States have made fairly adequate provision for inspection and have reported results on the forms received for that purpose from this board. This applies only to commercial shipments from countries having an official inspection and certification system.

Examinations of importations from other countries, namely, those without inspection system, must be made under the provisions of the act at port of entry by inspectors of this department as a condition of entry and delivery to the importer. The importations of this latter class are comparatively infrequent and usually of small amount.

The one point that is, perhaps, insufficiently guarded in the Federal plant quarantine act and regulations drawn thereunder is the leaving to State inspectors the important duty of the examination of all commercial importations of nursery stock. While it is true that many of the States have done this work probably as well as it could be done, other States, through lack of money and men, have not been able to inspect all shipments, and, in some few States, no attempt has been made to inspect at all. Fortunately, the States which receive the great mass of the imported stock have the best inspection service and are doing the best work. In going over the reports of the several States, only three States report no inspection whatever owing to the absence of any appropriation for this work. Several of the other States, however, made reports of occasional failure to inspect owing

to lack of time or inadequate appropriation and inspection force. The amount of stock that has gone uninspected represents, however, a very small percentage of the total importations, possibly less than 2 per cent, but, nevertheless, any neglect whatever opens an avenue of danger which should be closed.

A considerable number of commercial importations have come to the District of Columbia, and these have been inspected by experts from the Bureaus of Entomology and Plant Industry of this department. There have also been inspected over 1,000 lots of seeds and plants distributed by the Division of Foreign Seed and Plant Introduction of the Bureau of Plant Industry, as well as seeds and plants sent out through congressional distribution.

The nursery stock entering Porto Rico and the Hawaiian Islands is inspected for this board by the inspectors of the local government concerned, who have been appointed collaborators of the Department of Agriculture for the purpose of these special inspections.

The following table indicates the distribution of imported nursery stock by States:

State.	Number of cases.	State.	Number of cases.
Alabama.....	278	Montana.....	12
Arkansas.....	21	Nebraska.....	100
Arizona.....	2	New Hampshire.....	63
California.....	1,144	New Jersey.....	7,966
Colorado.....	111	New Mexico.....	1
Connecticut.....	1,177	New York.....	11,521
Delaware.....	29	North Carolina.....	167
District of Columbia.....	774	North Dakota.....	1
Florida.....	57	Ohio.....	2,475
Georgia.....	160	Oklahoma.....	7
Idaho.....	12	Oregon.....	244
Illinois.....	2,977	Pennsylvania.....	6,540
Indiana.....	510	Rhode Island.....	404
Iowa.....	422	South Carolina.....	15
Kansas.....	238	South Dakota.....	9
Kentucky.....	204	Texas.....	109
Louisiana.....	329	Tennessee.....	124
Maine.....	29	Utah.....	8
Maryland.....	404	Vermont.....	36
Massachusetts.....	3,602	Virginia.....	153
Michigan.....	851	Washington.....	200
Minnesota.....	314	West Virginia.....	248
Mississippi.....	25	Wisconsin.....	221
Missouri.....	451		
		Total.....	44,781

The countries of origin and amount and general classification of nursery stock imported during the last fiscal year are indicated in the subjoined table.

Persian Gulf region (Basra)	50	50	5	50	50	7,522	438,800	106,570	11,916	29,560	750	1,512	5,216	3,200	5	9,000	2,000
Peru.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50	.....
Philippine Islands.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Russia.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Scotland.....	1,064	41,027	248	75,046	.....	7,522	438,800	106,570	11,916	29,560	750	1,512	5,216	100	.....	75	.....
Spain.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,800	.....	6	.....
Straits Settlements.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sweden.....	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Trinidad.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Turkey.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	3,905,705	17,365,377	169,280	201,660	2,180,601	4,117,765	1,549,085	3,195,966	1,527,113	241,708	461,135	1,138,281	1,011,336	7,297,845	15,040	12,817	.....

RESULTS OF STATE AND FEDERAL INSPECTIONS, 1912-1913.

As a result of the better condition of the nursery stock and more thorough inspection given it prior to its exportation, the percentage of gipsy and brown-tail moths brought in has been very greatly decreased as compared with previous years. But four instances of gipsy-moth infestation have been reported on imported nursery stock, two of which were detected on Belgian stock and two on Japanese stock, and but one instance of brown-tail moth was reported, this infested stock originating in France. Stock from Japan has been more infested than that from any other country, but the stock from all the principal exporting countries has been found infested to a greater or less degree, and, in several instances, by insect pests and fungous diseases new to the United States and having very grave possibilities of future damage. All infested stock found has been thoroughly cleaned or destroyed.

Perhaps the most dangerous single item was a consignment of Irish potatoes imported from a locality in Peru thought to be the original home of this tuber, and found to be thoroughly infested, in some instances almost destroyed, by the larvæ of a coleopterous insect new to this country. This potato pest gave every indication of being, perhaps, a more dangerous enemy of this tuber than any insect enemy now occurring in the United States. Altogether, some 110 different insect pests and 19 or more fungous diseases have been detected on 169 shipments of imported nursery stock as reported by State and Federal inspectors.

All importations made by the Department of Agriculture are safeguarded by very rigid regulations and provisions for inspection and proper detention in quarantine or destruction, as the conditions may warrant.

FOREIGN PLANT QUARANTINES.

Under the provisions of section 7 of the plant quarantine act the following plant quarantines have been established:

WHITE PINE BLISTER RUST.—This is Quarantine No. 1, promulgated September 16, 1912, and amended and superseded by Quarantine No. 7, promulgated May 21, 1913. This quarantine was drawn to prevent the introduction into the United States of the white pine blister rust, and forbids the importation into the United States from each and every country of Europe and Asia of all five-leaved pines.

POTATO WART.—This is Quarantine No. 3, promulgated September 20, 1912, to prevent the introduction into the United States of the disease known as "potato wart," "potato canker," "black scab," etc., and forbids the importation into the United States from the countries of Newfoundland; the islands of St. Pierre and Miquelon; Great Britain and Ireland; Germany; and Austria-Hungary, of the common Irish potato (*Solanum tuberosum*).

MEXICAN FRUIT FLY.—This is Quarantine No. 5, and was promulgated January 15, 1913, to prevent the introduction into the United States from Mexico of the insect known as the Mexican fruit fly (*Trypeta ludens*), and forbids the importation into the United States from the Republic of Mexico of the following fruits: Oranges,

sweet limes, mangoes, *Achras* sapotes, peaches, guavas, and plums. It was amended February 8, 1913, to include, in addition to the above fruits, the grapefruit and its horticultural varieties.

PINK BOLL WORM OF COTTON.¹—This is Quarantine No. 8, promulgated May 28, 1913, to prevent the introduction into the United States of the pink boll worm of cotton, and forbids the importation into the United States of cotton seed of all species and varieties and cottonseed hulls from any foreign locality and country, excepting only the locality of the Imperial Valley in the State of Lower California in Mexico. The importation from the region specified in Mexico is governed by regulations.

Three of these foreign quarantine orders are absolute prohibitions of the entry of the goods covered, namely, the quarantines relating to the white pine blister rust, the potato wart, and the Mexican fruit fly. The pink boll worm of cotton is an absolute prohibition except as to certain States in Mexico. These quarantines are enforced through the active cooperation of the customs service of the Treasury Department.

DOMESTIC PLANT QUARANTINES.

Under the provisions of section 8 of the plant quarantine act the following domestic plant quarantines have been established:

MEDITERRANEAN FRUIT FLY.—This is Quarantine No. 2, promulgated September 18, 1912, to protect the United States from the entry of the Mediterranean fruit fly, now thoroughly established in the Hawaiian Islands. This quarantine prohibits the shipment of any of the fruits and vegetables specified in the Notice of Quarantine into or through any other State, Territory, or District of the United States.

GIPSY MOTH AND BROWN-TAIL MOTH.—This is Quarantine No. 4, promulgated November 5, 1912, and revised and amended as Quarantine No. 10, promulgated June 24, 1913. This quarantine describes and quarantines the districts in New England infested by the two moths named, and makes regulations governing the movement in interstate commerce of plants and plant products which may be infested from the areas quarantined.

DATE-PALM SCALE INSECTS.—This is Quarantine No. 6, promulgated March 1, 1913, to prevent the further distribution in the United States of two important date-palm scale insects. It quarantines certain counties in California, Arizona, and Texas, and makes regulations governing the interstate movement of date palms originating within the areas quarantined.

PINK BOLL WORM OF COTTON.—This is Quarantine No. 9, promulgated June 24, 1913, and applies to the Territory of Hawaii. It has the same object as the foreign quarantine on the same subject described above. It prevents the movement from the Territory of Hawaii into or through any other State, Territory, or District of the United States of all cotton seed and cottonseed hulls.

¹ Referring to the above, under date of Aug. 18, 1913, this quarantine was amended, providing, under regulation, for the entry from the States of Nuevo Leon and Tamaulipas, Mexico, of cotton seed (including seed cotton) and cottonseed hulls grown in the Rio Grande Valley in the States named.

ENFORCEMENT OF QUARANTINES.

The foreign quarantines, for the most part absolutely prohibiting the entry of the goods covered, entail very little difficulty in enforcement and little expense. In the case of the Mexican fruit-fly quarantine, however, on account of the contiguity of the two countries and the freedom of interchange of commodities there is risk of violation outside of commercial importations, which latter are sufficiently safeguarded by the customs officers, namely, by travelers or other persons who may go back and forth across the international line and may carry, for personal use, smaller or larger quantities of the quarantined fruits. Such fruits taken by a tourist en route, stopping over for a day or two at some border town, for example, El Paso or Nogales, might easily be carried by such traveler to the citrus regions of California or New Orleans or Florida, and thus become the means of the introduction of the fruit fly which the quarantine is supposed to guard against. The customs officers customarily do not examine all small luggage, and it has, therefore, been found necessary to supplement the customs officers with inspectors at the principal mainland ports of entry between Mexico and the United States, these inspectors to be with the customs officers and assist the latter in the inspection of baggage, meeting the trains and, if necessary, stopping foot passengers on the international bridges and highways.

The domestic quarantines provide, in general, for the movement of the quarantined articles under a system of inspection and certification. This entails a considerable force of inspectors in the cases both of the quarantine of the Hawaiian Islands, on account of the Mediterranean fruit fly, and the quarantine of certain districts of New England, on account of the gipsy moth and brown-tail moth, and, to a less degree, the date-palm quarantine and the pink boll worm quarantine, the latter covering also the Hawaiian Islands. The funds appropriated for this board would not be sufficient to do this work unaided. Fortunately, the New England quarantine, which, perhaps, entails the largest expense, has been very largely conducted in cooperation with the Bureau of Entomology under the appropriation by Congress for moth control in New England. The large inspection force under this fund has had charge of the inspection of nurseries and other plants and plant products in New England, and otherwise carrying out the provisions of the quarantine and regulations drawn thereunder. The inspection officials and force of the several New England States concerned have also been appointed, at nominal salaries, collaborators of the Department of Agriculture, to make it possible for them to officially represent the department in their work, and in this way the cost of the inspection and enforcement of this quarantine, which is very large, is divided between the appropriation for the Federal Horticultural Board and the moth fund and the State appropriations of the several States concerned.

Similarly the special appropriation by Congress for the investigation of the Mediterranean fruit fly has been used to carry out and give effectiveness to the Hawaiian quarantine against this insect in cooperation with the Federal Horticultural Board. Furthermore, the large item of expense in connection with this quarantine, namely, the port inspection of all steamers for contraband fruit arriving at the ports of California, Oregon, and Washington, is being made for this

board by the State inspectors who have been appointed collaborators of the Department of Agriculture for that purpose at nominal salaries. The cost of this California work alone, if it entirely devolved on the funds appropriated for the board, would nearly exhaust these funds.

Special need of port inspection on account of the Hawaiian quarantine arises from the fact that, under the provisions of section 8, the articles quarantined can only be prohibited from entering into interstate commerce, and this does not prevent any passing ship touching at Hawaii taking on board infested fruit for ship's stores or any traveler for personal use and conveying it across the Pacific to the mainland port. The law is not violated until the fruit has entered the mainland port of destination. This necessitates a very thoroughgoing examination and careful supervision of all vessels, passengers and passengers' baggage coming to California or other coast States from Hawaii. This work is now done, as hitherto, by the inspection force of the several States concerned, and the appointment of these State officials as collaborators of the department is for the purpose of investing them with the additional authority which comes from the Federal act.

FOREIGN INVESTIGATIONS.

Some foreign investigative work will be required from time to time to determine the need for quarantine action, and this work will be done so far as possible in cooperation with the Bureaus of Entomology and Plant Industry of this department. In this connection as thorough an investigation as was possible under the disturbed conditions was made in Mexico to determine the range of the Mexican fruit fly as a basis for the quarantine later promulgated against this pest. A similar investigation is now being made of fruit-fly conditions in Mediterranean countries. This last investigation is being conducted by Prof. H. J. Quayle, of the University of California, who is doing this work in cooperation with this board and at nominal cost.

PUBLICATIONS OF THE BOARD.

Rules and regulations for carrying out the plant quarantine act were promptly prepared by the Federal Horticultural Board, in cooperation with the Solicitor of the department, and were published as Circular No. 41, Office of the Secretary, September 25, 1912. Two revisions of this publication have been issued, the first of date December 20, 1912, and the second as Circular No. 44, Office of the Secretary, issued May 26, 1913, effective on and after July 1, 1913.

In accordance with the provisions of the act, rules and regulations have also been issued, of date May 31, 1913, for the importation of nursery stock by the United States Department of Agriculture for experimental or scientific purposes. Twenty-one other circulars and circular letters have been issued to meet the special needs, and a series of quarantine orders.

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